The New Zealand
Journal of Agriculture.

VOL. XL. WELLINGTON, 20TH MARCH, 1930. No. 3.

RELATIONSHIP AND CONTROL OF ANNUAL GRASSES AND CLOVERS IN PASTURE.

THE HAWKE'S BAY AND POVERTY BAY FLATS.

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IT is impossible to carry out wide-scope field-work such as that associated with the seed-production industry of Hawke's Bay and Poverty Bay without receiving strong impressions. Here one sees high-production pastures that can be ranked among the world's finest grasslands—those compact swards of rye-grass and white clover that indicate so well the presence of ideal conditions for pasture-growth; the thriving sheep and cattle; the setting of lofty poplars, canopied willows, and distant hills; the sunny skies—all go to make a satisfying rural picture (Figs. 1–3). On the other hand, one sees also far too much depletion of soil-fertility, indifference to drainage and flood-water control, failure to utilize surplus feed as hay or ensilage, failure to appreciate what actually constitutes a good pasture. The rye-grass and white clover, instead of being dominant as they should be over the whole of the plains country, are often starved and dwindled and their place occupied by inferior grasses and weeds.

We hold that what grows on the top indicates the conditions in the soil below, and that given the right conditions for rye-grass and white clover to thrive, together with the correct strains of each, these plants will clothe the land and will keep all comers at bay. The first-rate pastures of Britain, like those of New Zealand, contain more or less high proportions of perennial rye-grass and white clover, with a varying smaller proportion of cocksfoot, crested dogstail, and Poa trivialis: the higher the aggregate of these five species—so long as rye-grass is the dominant one—the higher is the carrying-capacity of the pasture. The grassland problem of Hawke's Bay and Poverty Bay lies in knowing how to grow to perfection the type of rye-grass and white

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clover these districts are fortunate to possess. Manuring and management should be directed towards creating and maintaining year in and year out ideal growing conditions for "rye and white."

Good as are the pastures of the Hawke's Bay and Poverty Bay flats, they too often fall short of the ideal in that they carry a more or less high total proportion of annual grasses and clovers (Figs. 4 and 5). The major problem of these districts is wrapped up in the elimination and control of the annual. The elimination of the annual is a piece of ecological work which, translated into practice, bids fair to rival in importance the elimination of scrub growths of the hill country, or the rush and perennial weeds of the wetter lowland pastures. Control is closely connected with an intimate study of the individual species and their requirement, and this work must be directed

FIG. 1. TYPICAL PASTORAL SCENE ON THE HASTINGS FLATS, CENTRAL HAWKE'S BAY.

The Hastings flats rank among the world's finest grasslands. Here is attained the ideal sward of dominant perennial rye-grass and white clover—high-production pasture in an attractive setting.

[*Photo by E. Bruce Levy.*

towards the setting-up of conditions that mitigate against the establishment and development of the annual—towards effecting that smaller or greater alteration of the habitat conditions which upsets the equilibrium of plant and habitat. At the present time the pendulum swings more or less at will—this year towards the dominance of annuals, next year towards that of the perennials. A comprehensive ecological study of the situation should direct the efforts of the farmer to prevent the recurring of conditions that favour the annual, and should tend to stabilize growth conditions so that the balance of power remains definitely with the perennial.

In this course we recognize the disturbing factor of climate. In a dry season, with the inevitable opening-up of the sward, and with slow autumn recovery of the perennial element and general falling-off of available soil - fertility owing to soil - dryness, the swing is essentially towards the annual; but we feel that (other than in years of prolonged

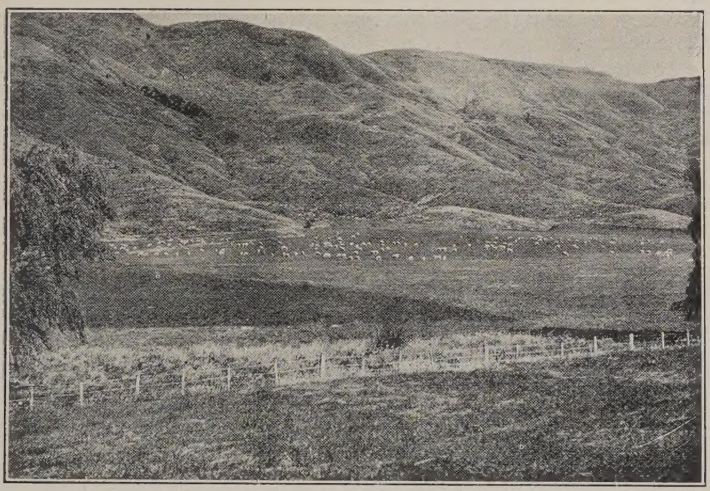

FIG. 2. A HAWKE'S BAY SCENE FARTHER BACK AMONG THE HILLS.

Here the smaller flats carry the same ideal turf, and produce, acre for acre, equal to the wider plains.

[*Photo by H. Drake.*

FIG. 3. CLOSE-UP VIEW OF AN OLD HAWKE'S BAY PASTURE—DOMINANT RYE-GRASS AND WHITE CLOVER, WITH SOME COCKSFOOT AND POA TRIVIALIS.

A vigorous sward such as this, dense to the bottom, will keep at bay allcomers, but just so soon as the turf weakens and opens up it is subject to invasion by a host of annuals and perennials that also thrive under the congenial conditions of the district.

[*Photo by E. Bruce Levy.*

drought) it is possible and practicable on the Hawke's Bay and Poverty Bay flats to create a condition that has a distinct bias towards the perennial.

It may be asked, What are the conditions that favour the annual? A content of annuals indicates a weakness, an openness of the sward at certain periods of the year, particularly at establishment time in the autumn. That weakness may be caused by any one of the following factors: (1) Prolonged drought; (2) production of hay or seed crops; (3) treading out of the turf by crowded stock in dry weather or by poaching in wet weather; (4) reduction in soil-fertility, leading to slow recovery of rye-grass and white clover after autumn rains; (5) sowing down, in the initial seeding, short-lived types of pasture plants that leave open spaces at their death.

Into pastures opened by any one of the above causes the annual gains entrance—at first it may be in small numbers. Most annuals ripen their seed before rye-grass, and even in the normally grazed pasture, owing in general to the unpalatable nature of the seed-head, seed of annual species is shed on to the bare spaces of the open sward. With the advent of rain these germinate and re-establish in the pasture, often in increasing numbers. How many farmers see their second consecutive seed crop dominant goose-grass, hair-grass, or barley-grass, instead of rye-grass; and instead of white clover in come burr, suckling and clustered clover. What increased wealth it would mean to Hawke's Bay and Poverty Bay if only the usurpation of the ground by this inferior annual element could be prevented. We venture to say definitely there is no place for the annual in ideal swards; further, that the ideal is attainable and, we feel sure, economically profitable on this country.

Common Annual Grasses and Clovers.

The most common of the annuals in Hawke's Bay and Poverty Bay are goose-grass, barley-grass, and hair-grass, spotted burr clover, toothed burr clover, suckling clover, clustered clover, haresfoot trefoil, and in parts subterranean clover and striated clover. The following brief notes set out the ecological relationship of these annuals, and the demands they make upon the habitat and the other sward constituents.

GOOSE-GRASS (*Bromus hordeaceus*).

Goose-grass is a species of wide habitat range requiring for its establishment, in common with all annuals, weak turf and open sward conditions, particularly in the autumn. On the poor soils it makes its presence felt as a diminutive plant, often extremely hairy, producing but a few fertile seeds on spindly stalks a few inches high; on the better soils its growth is correspondingly taller and stronger and seed-head larger; while on the more fertile soils typical of the Hawke's Bay and Poverty Bay flats heavy yields of unpalatable herbage and seed are annually produced.

Lack of competition—be the cause what it may—contributes to the successful establishment and growth of this annual. Its abundance in the Hawke's Bay pastures is due almost entirely, one would say, to using the paddock for seed-growing too frequently. In almost all paddocks seeded consecutively for two or three seasons goose-grass, excepting at the gateways, becomes virtually dominant; while in no case

have we found abundant goose-grass where the paddocks had been grazed for several consecutive years prior to shutting up. It is in the openness of the aftermath of a seed crop that goose-grass establishes, and once established it vies successfully with the rye-grass debilitated by the drain of the seed harvest and smother of the growing crop.

What would be the effect of strong aftermath recovery rye-grass on the seedlings of goose-grass is a question of high moment. How synonomous is the presence of goose-grass with lack of vigour of rye-grass is shown by the local belief that goose-grass is but a transmuted rye-grass run out and debilitated. True, it is that run-out debilitated

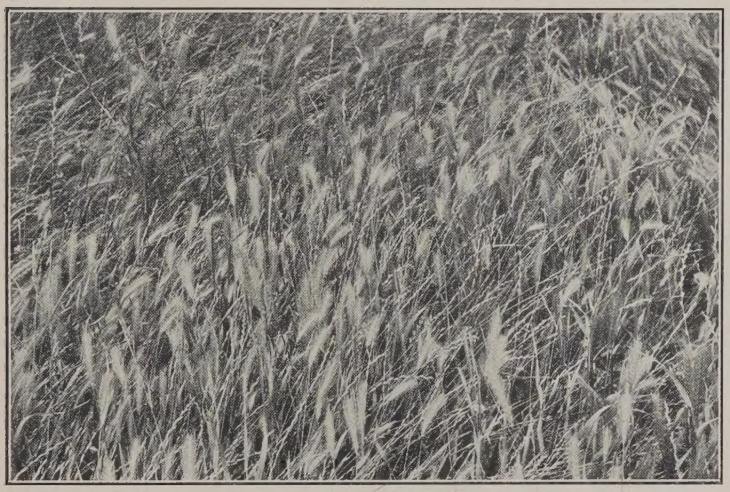

FIG. 4. A HAWKE'S BAY PASTURE RUN TO DOMINANT BARLEY-GRASS.

Similar photos could be shown with goose-grass, Yorkshire fog, Poa trivialis, or hair-grass dominant. These annual or perennial grasses thrive in this district equally well with rye-grass, but the set of conditions that govern their rise to dominance is different to that set which enables rye-grass to dominate them. The aim is to find out exactly what rye-grass demands, and then order our farming to provide the rye with those conditions.

[*Photo by E. Bruce Levy.*

rye-grass leads to goose-grass, and equally true that strong vigorous rye-grass gains mastery over this selfsame annual. One has but to look at gateways where the fertility is high and the conditions favour rye-grass; here it holds sway and stands second to none.

BARLEY-GRASS (*Hordeum murinum*).

Barley-grass is a demander of high soil-fertility; it does not persist as a dwindled, insignificant plant on poor soils in the same way as does goose-grass. It has a narrow habitat range; in other words, it dominates only under certain special conditions. Overtreading of the ground during summer to such an extent that rye-grass is literally trodden out, together with the inbrought fertility for which sheep-camps are so noted,

are the two major factors responsible for the presence of barley-grass. Again, in the case of the rich stack-bottom, where the rye-grass is killed entirely by smother and by much treading during the winter while stock are consuming the straw, high fertility and no competition favour barley-grass above all others. Around willow-trees, poplars, and in other spots in the paddock where stock camp, barley-grass is dominant, gradually thinning out as the degree of treading lessens, until the zone of rye-grass persisting under the lighter treading, but still high fertility, is reached.

Control of barley-grass seems a matter of stock-manipulation almost entirely, together with the use of the mower to prevent reseeding. Were it possible to wipe out all camp-sites the trouble from barley-grass would be almost eliminated. Such places are almost invariably the source of supply of seed that stock distribute to other small weak open spaces throughout the general run of the paddock.

HAIR-GRASS (*Festuca myuros*).

Hair-grass occupies areas of low fertility where there is little or no competition from perennial species. The interstices of a danthonia sward almost invariably hold hair-grass — fine-leaved, producing but scant edible herbage in the early spring, and running rapidly to unpalatable stem and seed in the early summer. The long bearded seed of hair-grass is a frequent impurity in danthonia seed, and so consistent is this species in the swards of danthonia that the Maori has come to regard it as the "daddy of danthonia—no hair-grass, no danthonia." It only goes to show that hair-grass is essentially an inhabitant of low-fertility soils. No rye-grass or any other plant of high producing capabilities could thrive on soils running dominantly to hair-grass. The fertility of those soils must be raised.

SPOTTED BURR CLOVER (*Medicago maculata*) AND TOOTHED BURR CLOVER (*M. denticulata*).

The more common of these two species in New Zealand is spotted burr clover, but as their ecology is similar they are treated as one under the general term of "burr clover."

Loose soil conditions, moderately fertile to fertile, with little competition from perennial species, are essential conditions for burr clover. In a sense burr clover, when once established, creates its own conditions as far as weak turf is concerned. Stock neglect it because of its unpalatable herbage, and so rank and prolific is its growth that it often overtops and actually smothers out the rye-grass and white clover, leaving at the end of summer bared and open sward well seeded down for the perpetuation of its kind on the advent of autumn rains.

Control would appear to centre in management of the sward — to graze it moderately low, and to keep, by mowing if necessary, the heavy smother away from the rye-grass and white clover, together with stimulation of the rye with a quick-acting manure that favours grass rather than clover. Sulphate of ammonia immediately appeals. To control burr one has got to get the grass. A tight and vigorous turf is essential, and it would appear that where burr is bad, ploughing and resowing to a good rye-grass, together with feeding and managing of the new sward, is the course to pursue.

SUBTERRANEAN CLOVER (*Trifolium subterraneum*).

Subterranean clover is a highly palatable annual which establishes in the autumn in a weak turf (generally made so by its own prolific spring growth) much in the same way as in the case of burr clover. Ecologically, subterranean clover resembles burr clover, and the same conditions of fairly fertile to fertile conditions must apply. One can place subterranean clover in the fertility scale between white clover above and suckling clover below. The palatable nature of subterranean, however, renders it useful and easy to control. In a grazed sward, with an increase of fertility during the autumn recovery of the pasture and into the winter, it is possible to so stimulate white clover that this

FIG. 5. A HAWKE'S BAY PASTURE RUN TO DOMINANT SUBTERRANEAN CLOVER.

Here also burr clover, clustered clover, or suckling clover dominant could be similarly shown. These four annuals, as in the case of the annual grasses, thrive wonderfully in Hawke's Bay and Poverty Bay; but just as the annual grasses should be replaced by rye-grass, so these annual clovers should be replaced by white clover. Here again it is a question of ordering our farming to provide white-clover conditions and not those that favour the annuals.

[*Photo by E. Bruce Levy.*

perennial species can vie successfully with the annual. The aim in dealing with two equally palatable species is to raise the fertility, so that the perennial jumps away in the autumn before the annual germinates and establishes from seed. Given haying-conditions, however, subterranean clover, with its temporary higher-yielding and higher-growing nature, will subdue white clover and even badly smother rye-grass.

SUCKLING CLOVER (*Trifolium dubium*).

Suckling clover is perhaps the most cosmopolitan species of low-fertility soils known in pastoral agriculture; it is essentially an indicator of low fertility—soils too poor for white clover to thrive in. Control of suckling on any lowland pasture is primarily a matter of increase

of fertility by top-dressing. The quantity of this seed dressed out of Hawke's Bay and Poverty Bay rye-grass is altogether too large. In the trade it is worth about 4d. per pound, whereas white clover, which should be made to replace this annual, fetches three times that price or more. Suckling in itself is a wonderful little clover, hardy, palatable, and with an extremely wide habitat range as to soil-type; it is a free seeder and ready establisher, and gives a great response to phosphatic manures. As a matter of fact, on many soils more than half the value of the manuring is secured through suckling clover. But this does not justify its presence on the Hawke's Bay and Poverty Bay flats. This country should be made to carry white clover in every spot now dominated by suckling. Control is relatively simple on this class of country, and lies in the upkeep of a higher scale of fertility than is maintained at present.

CLUSTERED CLOVER (*Trifolium glomeratum*).

The essential difference between suckling clover and clustered clover ecologically is the wideness of range of the former and the narrowness of range of the latter. The fertility-requirement of each is essentially the same. Clustered clover prefers light, free, open soils, and is very partial to the sea-coast. In growth habit it is spreading rather than erect, and the light-canary-yellow matt-surface seeds are borne in clusters right in the axil of the leaf or on a very short seedstalk. The seed has often passed through commercial channels as white clover—needless to say, much to the chagrin of the farmer buying such seed. In value clustered clover approaches suckling, but the same remarks apply to this species as to the latter—it should be ousted by stimulation of white clover on all the Hawke's Bay and Poverty Bay flats.

STRIATED CLOVER (*Trifolium striatum*).

This clover is not very common on the Hawke's Bay and Poverty Bay lowland country. It occupies a position in the fertility scale along with and is ecologically equivalent to clustered clover.

HARESFOOT TREFOIL (*Trifolium arvense*).

Lower down in the fertility scale, below suckling clover and clustered clover, in company with English hair-grass (*Aira caryophyllea*) and other lowly weeds, comes haresfoot trefoil. This clover is extremely unpalatable, and occupies soils in the North Island at least virtually on the lowest rung of the ladder, such as stony river-beds or sands that dry out extremely rapidly. We make no recommendation at the present moment in the matter of improving these soils.

Two Perennials affecting Rye-grass.

In addition to the foregoing annuals there appear on the Hawke's Bay and Poverty Bay flats in varying degree two perennial grasses—Poa trivialis and Yorkshire fog—between which and rye-grass we feel there is a definite relationship.

POA TRIVIALIS.

This grass is essentially suited to rich soil conditions, to situations inclined to be wet rather than dry. In the fertility scale we place it

just below rye-grass, but it is essentially tolerant of wetter conditions than rye-grass can stand. It spreads and gains in a pasture in virtue of stem tillering rather than crown tillering, and its root-system originates from creeping stems that are entirely above ground. On this account Poa trivialis is very susceptible to drought, and under normal summer conditions it dries up and almost entirely disappears from the sward, leaving as a result a marked openness in the pasture.

Poa trivialis seeds freely and ripens its seed before rye-grass, and the seed shed on to the ground establishes itself after the rains of autumn. In a wet season—such as this year's—Poa trivialis may be

FIG. 6. A STRIKING ILLUSTRATION IN HAWKE'S BAY OF RESPONSE TO CONDITIONS SET UP.

Across this paddock, running from the foreground of the photo to the middle distance, is a stock-track about 8 ft. wide, this being dominant rye-grass. On each side, throughout the whole of the paddock, Yorkshire fog, goose-grass, and Poa trivialis are dominant. This is highly suggestive of possibilities in manuring and management.

[*Photo by E. Bruce Levy.*

very prevalent and persist throughout the summer. On areas where the sward has been drowned out by flood—rye-grass does not stand flood conditions for long—Poa trivialis may dominate, as was found to be the case on many low-lying paddocks this year. As an associate species for rye-grass we welcome Poa trivialis, yet we would stress the point that gain to dominance over rye-grass indicates a condition which should be rectified. Flood-control is essential for the rye-grass pasture, and drainage to remove soggy pasture conditions in the winter, together with upkeep of fertility, are essential features to give rye-grass the ascendency over Poa trivialis. On rich, constantly damp soils Poa trivialis is a first-rate grass, and as a bottom species would seem to have a wider application in New Zealand pastures than it occupies to-day. We would stress the point again, however, that a high

percentage of Poa trivialis (just as in the case of a high percentage of white clover) indicates a weakness in the rye-grass content of the pasture.

YORKSHIRE FOG (*Holcus lanatus*).

This cosmopolitan species in many respects demands the same conditions for its spread as does Poa trivialis. Moderately rich soil with damp surface conditions are most congenial, and given such conditions spread of Yorkshire fog may be quite rapid, either by establishment of seed or by stem and crown tillering. A weak, drowned-out, open turf affording little competition favours Yorkshire fog and Poa trivialis alike. Yorkshire fog, however, has an extremely wide habitat range in comparison with the comparatively narrow habitat range of Poa trivialis. It will thrive on the most fertile of soils, and under rank growth conditions may become dominant; it persists strongly on dry light soils and on stiff clay soils. In fact, this grass is to be found on almost every type in varying degree, contributing often a quota of feed that is seldom appreciated by the farmer. Under dry conditions it persists by means of crown tillering rather than stem tillering, and stimulates the tussock form rather than turf grass. This flexibility of form in Yorkshire fog would appear to govern its wide range persistency.*

As a competitor to strong-growing, well-utilized rye-grass Yorkshire fog takes second place, and this is the point we particularly wish to make in regard to the Hawke's Bay and Poverty Bay pastures. An increase of Yorkshire fog—just as in the case of Poa trivialis—indicates a weakness in the rye-grass brought about either by too much wet in the winter, too much rank growth in the spring, or too low a soil-fertility upkeep.

The relative position of rye-grass on the one hand and Yorkshire fog and Poa trivialis on the other are clearly exemplified in Fig. 6.

Suggestions for Control of the Annual.

From the foregoing matter it will be seen that an annual relies on abundant reseeding for its propagation from year to year. It has to re-establish from that seed, and for successful re-establishment competition from existing adult plants of perennial species in the pasture must not be too severe. Here is the weak link in the life-history of the annual, and it is at this weak link that the farmer's efforts must be levelled. The aim must be to so manage the pastures that the perennial plants of the sward — rye-grass, white clover, and other bottom grasses such as Poa trivialis and crested dogstail—shall spread or tiller out rapidly after any opening-up by whatever cause — by treading, through drought, or by smother caused by hay or seed crop. In any recovery period the sward must be tightened up so as to stifle the annual species during this initial phase of its re-establishment.

In the majority of the better-class pastures of Hawke's Bay and Poverty Bay there seems sufficient rye-grass present to effect the desired thickening-up of the existing sward with a view to preventing the establishment of the annual seedlings, but there is no doubt that to do this systematic manuring, properly applied, must be practised. From an analysis of patches which stock have manured heavily it is

* Strain selection work on Yorkshire fog now being undertaken by the writers may throw more light on the reason for the wide-persistency range of this species.

FIG. 7. A ROADSIDE STUDY IN HAWKE'S BAY.

The edge of the roadway for a width of approximately 3 ft. is pure rye-grass; for the next 6 ft. approximately it is rye-grass and white clover; then comes a zone where the rye-grass is less vigorous and Yorkshire fog and Poa trivialis are dominant.

FIG. 8. CLOSE-UP VIEW ON AN OLD HAWKE'S BAY PASTURE SHUT UP FOR SEED.

Here rye-grass is dominant with good white clover. When this crop is cut there will inevitably be a temporary opening-up of the sward. Quick recovery of the perennials is necessary to beat the annuals. An application of quick-acting manure must be of great assistance in quick recovery of the rye and white clover.

[*Photos by E. Bruce Levy.*

evident that low fertility at certain seasons of the year is the major factor contributing to lack of perfection in these pastures. In almost every paddock one can see on and around manure droppings small or large areas that are almost ideal in composition and carrying-capacity. These are deep green in colour, vigorous in growth, and almost pure rye-grass, white clover, and Poa trivialis, with in most instances a total suppression of the annual (Fig. 7).

The question is, Can not one profitably attain to this perfection over the whole paddock and over the whole area? We claim that by the use of artificial manures, coupled with efficient utilization, it is quite possible and profitable (Fig. 8).

It is claimed by many men on the East Coast flats that superphosphate brings on too much clover, and that it increases the abundance of annual weeds; yet some of those holding the finest grasslands in these areas are regularly top-dressing with phosphate. Their paddocks are dominantly rye-grass, white clover, and Poa trivialis, but we would agree with our critics that these paddocks in general carry too low a proportion of rye-grass in relation to clover. This can to a large extent be put right by the use of quick-acting nitrogenous manures, such as sulphate of ammonia, which will react quicker on the rye-grass than on the clovers, and, we claim, will bring rye-grass up to the position of being the dominant species in the pasture.

We feel that in the past a good deal of misconception of the value of manuring has arisen as the result of manuring pastures that have run largely to rubbish. If the rye-grass has gone or is badly weakened through years of neglect and consequent depletion of soil-fertility the rubbish will certainly respond to the application of fertilizers, and it may take several years of top-dressing before the rye-grass has sufficiently recovered in vigour to successfully compete with and eliminate the poorer elements of the pasture.

In many cases it must pay very much better not to put an ounce of manure on these very run-out pastures, but to break them up and resow and then to manure, using a mixture of phosphate and nitrogen. These should be quick-acting fertilizers to aid particularly quick establishment and recovery of the perennial in the autumn, before the annual re-establishes itself; and subsequently in the spring, after the opening-up by stock-treading, quick recovery again closes up the turf and shuts out the light at the ground surface, thus stifling spring and summer annual establishment.

Manuring, coupled with efficient utilization of the pasture, seems the keynote to improvement. In the process of bringing pastures back after manuring, to prevent reseeding of the annual and to give rye-grass and white clover free scope to develop and spread, early spring mowing and making of the material into ensilage appears to be very hopeful where control by grazing is difficult.

In seed-production, also, manuring and invigorating the sward may need be accompanied by better early control of the grazing, with a tendency to shut up the area later rather than earlier.

Out of manuring in Hawke's Bay and Poverty Bay there are bound to come added problems of utilization which may call for modification of existing farm practices. We have every confidence, however, that the local farmer will prove as amenable to change as is the sward itself.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1929.

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AFTER having shown a steady falling-off each year since 1924, entries for Certificate-of-record Test are now again on the increase. Twenty-six more cows qualified for certificate in 1929 than in 1928, and figures for the peak month of the current season show 864 cows on test on the farms of 272 breeders, as compared with 655 cows and 225 breeders for the highest month of last season. On a percentage basis this increase is by no means insignificant, and, further, there is reasonable prospect of the advance being sustained for another season at least.

As has been frequently stated, one of the principal objects in introducing the Certificate-of-record Test was to provide sires for ordinary dairy herds, sires which, because they are registered purebred and with C.O.R. butterfat-record pedigrees, would be of the greatest possible value in herd-building and in improving the yield of our average dairy cow. The support accorded the C.O.R. system is necessarily regulated to a considerable extent by the demand for bulls from C.O.R. cows, as the breeder of purebred dairy stock is largely dependent upon sales for his income. For some years past the prices offered for butterfat-backing C.O.R. bulls have hardly warranted any extensive C.O.R. testing programme on the part of breeders. The demand, however, is steady, and from a survey of recent sales results it is probably slightly improving. No doubt the marked advance of group herd-testing and its valuable educational service is having a favourable effect on the general position.

While the number of cows qualifying for certificate of record each year may be small in comparison with the total number of registered purebred dairy cows in the Dominion, there is perhaps a tendency to underestimate the number of bulls from C.O.R. cows available for service. The cumulative effect, which is considerable, must not be overlooked. We have taken out roughly an estimate of the number of bulls from C.O.R. cows which should be alive and available for service next season—1930–31. The estimate has been based on cows which have received certificates or have failed other than on production. Adjustment for age was needed in the case of the mature class, which includes cows five years old or over at commencement of test, and for purposes of the estimate the age of the average tested mature cow was taken as seven years. The other classes are based on the exact year of age, and thus no adjustment was necessary. The maximum age of the average cow was taken at nine years, or the birth of eight calves. A bull was assumed to be fit for service at a minimum of one year and a maximum of nine years. Actual C.O.R. records were taken to the end of 1929, but an estimate was necessary as to the number of cows of those at present on test which will qualify during the present calendar year. It has also been supposed that half the calves will be bull calves. The result comes out at 13,737

bulls, from yearling to not more than nine years of age, in the spring of 1930. Obviously when a cow completes a certificate-of-record test her performance affects all calves which have been born to her as well as those calves which may yet be born.

The Official Herd-test also provides for recording the yield of registered purebred dairy cows, and, while a detailed survey of this system would be out of place in the present review, it may be stated that working along similar lines on this test, which is now in its third season, and assuming a cow to be tested when she has been on test 180 days (six months) or more, it is found that 6,888 bulls from O.H.T. cows should be available for service in the spring of 1930. Added to the total of 13,737 bulls from C.O.R. cows, this makes the impressive grand total of 20,625. While, as previously mentioned, certain assumptions were necessary, and while some of the hypotheses may be open to difference of opinion, the result of the investigation can probably be taken as a reasonable indication of the position. Mortality would need to be considered, and also deformity, but, on the other hand, the estimate is perhaps conservative.

There has been of late a revival of interest in the question of a ten-months class for C.O.R. cows, and it is probable that the additional class will be inaugurated next season. There is much to be said on the subject, both for and against, and we hope to deal fully with the matter at a later date.

Some consideration has also been given to the question of dispensing with the butterfat standards for C.O.R. cows, it having been suggested that a certificate be issued to every cow which qualifies on the present rules other than those pertaining to quantity of butterfat. The elimination of the minimum production requirement did not, however, meet with the approval of all the breeders' associations. Moreover, the proportion of cows which fail to qualify on production is very small. It has therefore been decided to make no change in the present system in the meantime.

A matter which has given a certain amount of concern is the increase in the number of cases of lost milk-weights. The most common causes of such losses have been the destruction of the shed sheets by cows or calves, or the sheets have been torn off and blown away by the wind. Breeders should be particularly careful to see that the shed record sheets are kept in a safe place, as no allowance can be made for lost weight-records.

Owing to the demand on the limited space of the *Journal* it may be necessary to discontinue the publication in it of the C.O.R. lists throughout the year. The records now receive publicity each month through the official organs of the various breeders' associations, and it is considered that the position might be satisfactorily met by the publication once a year of an official pamphlet containing a complete list of particulars of certificates issued during the year, together with the annual review from the *Journal*. This would be sent free of cost to all C.O.R. testing breeders, and also made available to other interested persons.

The average production of all C.O.R. cows granted certificates during the calendar year 1929 works out at 469·95 lb. butterfat. The

averages for the preceding four years were 467·92 lb. in 1925, 463·87 lb. in 1926, 469·56 lb. in 1927, and 469·53 lb. in 1928.

FIRST-CLASS CERTIFICATES ISSUED.

From the commencement of the C.O.R. system to the end of 1929 first-class certificates of record have been issued to 6,604 cows. In 1929 417 first-class certificates were issued to cows qualifying for the first time, and 74 to cows which had previously gained a certificate, making a total of 491 certificates for the year. Particulars of certificates issued during the past two years are given in the following table :—

Table 1.

Breed.	1929.			1928.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	315	52	367	328	39	367
Friesian	68	18	86	66	13	79
Milking Shorthorn..	26	..	26	10	1	11
Ayrshire	6	2	8	3	2	5
Red Poll	1	2	3	2	..	2
Guernsey ..	1	..	1	1	..	1
Totals ..	417	74	491	410	55	465*

* Representing 464 cows, one cow having qualified for two certificates within the year.

SECOND-CLASS CERTIFICATES.

The number of second-class certificates issued during the year under review totalled twenty-eight, as compared with twenty-two for 1928. The twenty-eight certificates went to twenty-four Jerseys, three Friesians, and one Ayrshire respectively. The Jerseys averaged 445·52 lb. butterfat, the Friesians 612·97 lb., and the Ayrshire 529·35 lb. As most readers will know, the rules for the two classes of C.O.R. are identical, except that for a first-class certificate a cow must drop a calf within 455 days (fifteen months) after date of calving for commencement of test, whereas for a second-class certificate an extra thirty days is allowed, making 485 days, or, roundly, sixteen months between the calvings.

Jerseys.

Class-leaders.

The year under review brought forward no records which seriously challenged the existing class-leaderships of the Jersey breed, the list of highest producers having now remained unaltered since 1927. The list is repeated in Table 2 (next page).

Jersey Class Averages.

The Jerseys certificated in 1929 numbered 367, with an average production of 455·51 lb. butterfat. This represents a decrease of 1·41 lb. from the 1928 average of 456·92 lb. for the same number of cows. From Table 3 it will be seen that all classes except the junior

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Ivondale Oxford Lass	R. S. Tuck, Waharoa..	1 338	240·5	365	12,107·7	731·29
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old.						
Ivondale Golden Lass	P. J. Petersen, Waitara	3 312	308·2	365	14,434·8	905·01
Four-year-old.						
Keston Flower ..	G. E. Yelchich, Waiuku	4 64	319·9	365	14,679·2	814·95
Mature.						
Holly Oak's Annie..	W. T. Williams, Pukehou (deceased)	5 9	350·0	365	18,522·7	1,056·49

two-year-old show an increase over the previous year. Seeing, however, that the junior two-year-olds are in an overwhelming majority numerically, it is obvious that a decrease in average production for this class must have an inimical influence on the average for the whole breed.

The following table supplies class averages for 1929 and 1928 :—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb.	lb.
Junior two-year-old ..	164	342	6,930·3	387·64
Senior two-year-old ..	29	352	8,202·4	468·42
Three-year-old	45	347	8,850·5	495·46
Four-year-old	44	342	9,403·9	525·45
Mature	85	340	9,630·7	524·68
1928.				
Junior two-year-old ..	174	350	7,385·8	415·60
Senior two-year-old ..	33	349	8,046·0	455·06
Three-year-old	58	339	8,585·5	481·87
Four-year-old	37	348	9,108·6	498·11
Mature	65	339	9,396·4	522·78

The total number of certificates issued to Jersey cows from the commencement of the C.O.R. system in 1912 to the end of 1929 has now passed the five-thousand mark, the exact figure being 5,207, and although the average butterfat production for all junior two-year-olds to date has lost a little ground since the end of 1928 (0·27 lb.) the breed as a whole has shown an advance of 1·41 lb., the average for the 5,207 certificates being 446·97 lb.

FIG. 1. SILVER MAHONE (G. S. B. MORRISON, MAUNGATAPERE).

C.O.R. in Jersey senior two-year-old class: 11,507·7 lb. milk, 665·94 lb. butterfat. Highest record for the class in 1929.

FIG. 2. BEECHLANDS PREFERENCE (A. MORELAND AND SONS, TE RAPA).

C.O.R. in Jersey mature class: 15,540·3 lb. milk, 847·49 lb. butterfat. Highest record for the class in 1929.

An interesting point connected with production of the Jersey breed is the marked consistency of the average butterfat test of the milk. To the end of 1929 this came out at 5·55 per cent., and for many years it has not varied more than 0·01 from that figure. Moreover, the latest reviews which have come under our notice indicate that for the Island of Jersey, England, the United States, and New Zealand the average test for the Jersey breed is within 0·01 of 5·55 per cent. This surely points to a remarkable stage of standardization in the breed.

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in the following table :—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	2,075	345	6,987·4	390·88
Senior two-year-old ..	549	344	7,741·5	435·92
Three-year-old	795	342	8,397·1	467·46
Four-year-old	508	345	8,892·7	493·50
Mature	1,280	345	9,329·7	511·45
All	5,207	344	8,043·8	446·97

Jersey C.O.R. Bulls.

For the benefit of those who may not be conversant with this part of the system we repeat the explanation that by a "C.O.R. bull" is meant a bull which has sired at least four certificate-of-record daughters, each from a different dam. The New Zealand Jersey Cattle Breeders' Association makes a special classification under the heading of "Champion Butterfat Bulls," but the conditions relating to this class have recently been changed by the Association. Under the original conditions a bull was considered to be eligible for the Champion Butterfat class when he had sired at least five daughters from different dams, and each daughter having doubled her minimum butterfat requirement for certificate. Under the conditions which are to apply in future, however, it is required that bulls have five or more daughters (each from a different dam), which, under first-class C.O.R. conditions, produce 520 lb. butterfat when starting under test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, and 700 lb. when five years old or over.

On account of the rapidly increasing number of C.O.R. bulls it has been found necessary to discontinue the publication of the list of names and particulars in this annual review, and merely to give a statistical summary. Details are always available from the respective secretaries of the breeders' associations, or from the office of the Director of the Dairy Division, Wellington. Comprehensive particulars are also supplied in the year-books issued by the Friesian and the Jersey Associations as regards their own breeds.

Some 320 bulls have now qualified for the Jersey C.O.R. list. The number of bulls which added to their list of C.O.R. daughters during the year was sixty-one, while twenty-eight bulls newly qualified for the class. The total number of champion butterfat bulls to date under the original rule is fifteen, and nine of these are eligible under the new conditions.

Friesians.

Class-leaders.

The list of Friesian class-leaders remains unaltered, and, as in the case of the Jersey breed, no records were made during 1929 which at any stage of the test looked like superseding those of the present champions. The Friesian breed has remarkably good leadership performances to its credit, and it must be realized that any animal which can displace the present title-holders will be indeed a champion. The past year has been below the average in the matter of high producers, this applying to practically all the breeders.

The list of class-leaders is repeated as follows :—

Table 5.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs. dys	lb.		lb.	lb.
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old.						
Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old.						
Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old.						
Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

There have been some rather marked ups and downs in the Friesian class averages for the past two years, and the wide variations are obviously due to the influence of individual performances, the

majority of the seven classes being very small. Even so, however, it is noticeable that the ages are more evenly distributed in 1929 than in 1928. Eighty-six Friesians were certificated in 1929, as compared with seventy-nine in the previous year. The average Friesian in 1929 produced 534·51 lb. butterfat, a very creditable increase over the 1928 figure of 527·97 lb. The class averages for the breed for the past two years are as follows:—

Table 6.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb.	lb.
Junior two-year-old ..	25	347	13,631·1	477·98
Senior two-year-old ..	12	353	13,458·9	477·34
Junior three-year-old ..	4	359	17,549·8	598·48
Senior three-year-old ..	10	324	14,774·2	527·45
Junior four-year-old ..	5	356	17,296·2	601·58
Senior four-year-old ..	10	328	15,869·8	564·49
Mature	20	354	17,675·6	598·47
	1928.			
Junior two-year-old ..	27	339	12,586·7	430·79
Senior two-year-old ..	13	351	13,668·6	490·17
Junior three-year-old ..	5	320	12,345·1	449·25
Senior three-year-old ..	8	362	16,300·8	602·37
Junior four-year-old ..	4	365	17,406·8	604·63
Senior four-year-old ..	4	361	17,122·1	622·87
Mature	18	352	18,867·1	651·74

Friesian cows in New Zealand have now received 1,743 certificates since the inauguration of the system in 1912. The average production to date works out at the substantial figure of 479·06 lb. butterfat, an increase of 2·88 lb. over the average to the end of 1928. Also, the average milk-yield has gone up almost 90 lb. The figures, class by class, are given in the following table:—

Table 7.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	500	345	11,490·6	406·67
Senior two-year-old ..	228	346	12,406·0	440·07
Junior three-year-old ..	162	341	13,229·4	464·69
Senior three-year-old ..	164	335	13,732·5	491·15
Junior four-year-old ..	105	344	14,938·7	526·09
Senior four-year-old ..	105	345	15,653·9	544·76
Mature	479	340	15,724·5	549·18
All	1,743	342	13,604·9	479·06

Friesian Bulls.

Friesian C.O.R. bulls—that is to say, Friesian bulls which have four or more C.O.R. daughters, each from a different dam—now total ninety-nine, of which number four qualified for their place during 1929. The number which added to their C.O.R. daughters during the year, or newly qualified for the C.O.R. class, was twenty-three.

FIG. 3. DUTCHLAND MAKANUI OF OAKVIEW (OAKVIEW STUD FARM, AUCKLAND). C.O.R. in Friesian mature class: 21,556·2 lb. milk, 754·72 lb. butterfat. Highest record for the class in 1929.

Milking Shorthorns.

Class-leaders.

Although there were no changes in the Milking Shorthorn class-leaderships during the year, some good performances were recorded. The senior two-year-old Dominion Althea of Ruakura, bred and tested at the Ruakura Farm of Instruction, Hamilton, gave 537·93 lb. butterfat, which is less than 5 lb. behind the record of the present class-leader. The mature class was a strong one, pride of place for the year being won by Mr. T. W. Wardlaw's Riverdale Florrie 2nd, with 761·17 lb. butterfat. Creditable records were also made by the same owner's Riverdale Florrie 3rd and Riverdale Grace 3rd, with 681·09 and 629·36 lb. respectively. Mr. Wardlaw (whose farm is at Waimana, Bay of Plenty) thus has the distinction of having tested the three highest-yielding Milking Shorthorns for the past year.

The list of class-leaders is repeated in Table 8.

Table 8.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

It is pleasing to record an increase of fifteen certificates for the Milking Shorthorn breed, there having been twenty-six cows certificated in 1929, compared with eleven in 1928. A list of class-averages is of little value, as fourteen of the twenty-six cows fall in the mature class, and the remaining six classes of the seven into which this breed is subdivided contain only one, two, or three records. The average for the breed, however—466·54 lb. butterfat—is very satisfactory, although showing a decrease from the preceding year's average of 480·96 lb.

Details of the class-averages for 1929 are as follows:—

Table 9.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb.	lb.
Junior two-year-old ..	2	309	9,466·5	400·67
Senior two-year-old ..	3	342	10,491·7	471·25
Junior three-year-old ..	2	313	10,468·3	433·41
Senior three-year-old ..	1	339	8,872·9	343·29
Junior four-year-old ..	2	332	12,132·4	468·17
Senior four-year-old ..	2	335	8,645·5	351·19
Mature	14	337	12,287·0	504·72

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table:—

Table 10.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	49	349	8,488·0	348·29
Senior two-year-old ..	27	346	8,731·8	360·96
Junior three-year-old ..	22	333	9,594·6	383·88
Senior three-year-old ..	23	342	10,549·9	446·79
Junior four-year-old ...	20	347	11,008·1	443·34
Senior four-year-old ..	26	343	11,612·3	457·94
Mature	241	340	11,662·6	466·58
All	408	342	10,877·8	438·12

Milking Shorthorn Bulls.

The number of C.O.R. bulls of this breed remains as at the end of 1928, no bulls having newly qualified during the past year. There are at present eight Milking Shorthorn bulls on the C.O.R. list, two of these having added to their C.O.R. daughters during the year under survey.

Ayrshires.

Class-leaders.

One change has taken place in the Ayrshire class-leaderships, this occurring in the three-year-olds. Mr. A. M. Weir's Ivanhoe Stylish Daisy, with 574·09 lb. butterfat, yields place to Fair Lass of Greenbank, whose fine record of 639·85 lb. increases the leadership of the class by over 65 lb. She was bred and tested by Mr. W. Moore, of Homebush, Masterton, and is but one of several outstanding individuals raised by Mr. Moore. Fair Lass of Greenbank is from a long line of well-known Ayrshire ancestry, production being a strong feature of the pedigree. The ability to reproduce production-capacity is also apparent, and this, after all, is as important in the practice of breeding as the making of high records. Fair Lass of Greenbank is line-bred to the imported bull Dominion Netherton Good Bonus, who appears on both sides of her pedigree and was the paternal ancestor of many fine Ayrshires bred by the New Zealand Government. Fair Lass of Greenbank also traces to Craigellachie, said to have been one of the finest Ayrshire bulls ever imported into New Zealand, and sire of Alexandra of Waipapa, who, with 591·16 lb. butterfat, was for many years the highest C.O.R. cow of the breed. The class-leaders for the Ayrshire breed are set out in Table 11 (next page).

Ayrshire Class Averages.

Eight Ayrshire cows received first-class certificates during 1929, as compared with five in 1928. Two of the eight cows were in the three-year-old class, their average production being 470·65 lb. butterfat. One four-year-old gained a certificate for 526·83 lb. butterfat, while five mature cows averaged 476·74 lb. All eight cows averaged 481·48 lb., as compared with an average of 520·02 lb. for the five cows certificated in the preceding year.

Table 11.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Fair Lass of Greenbank	W. Moore, Homebush	3 306	307·5	365	16 110 4	639·85
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are supplied by the following table :—

Table 12.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old*	51	342	8,702·2	357·96
Three-year-old	32	345	9,947·9	406·57
Four-year-old	24	348	11,229·5	458·54
Mature	99	347	11,956·6	487·04
All	206	346	10,754·2	439·26

* No additions in 1929.

Ayrshire Bulls.

There have been no additions during the year to the list of Ayrshire C.O.R. bulls. The list numbers seven, and only two of these bulls added to their C.O.R. daughters in 1929.

Red Polls.

Only three Red Poll cows gained certificates in the year under review, and two of those had been granted certificates previously, so that only one cow was really added to the C.O.R. list of this breed. Of the three cows mentioned, one, Wayward 6 B No. 1, with a C.O.R. for 536·50 lb. butterfat, becomes leader of the mature class, replacing Dominion Sylph (505·84 lb.), a cow bred and tested at the Central Development Farm, Weraroa. Wayward 6 B No. 1 is owned by Mr. G. S. Young, of West Plains, Invercargill, and is the holder of the

WAYWARD 6TH B NO. 1 (G. S. YOUNG, WEST PLAINS, INVERCARGILL).

Leader of the Red Poll two-year-old, four-year-old, and mature classes.

premier place in three of the four classes into which the breed is subdivided. It is quite obvious from a survey of this cow's performances that she is one of the leading matrons of the breed.

The class-leaders for the Red Poll breed are now as follows:—

Table 13.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk.	Butter-fat.
		Yrs.dys.	lb.		lb.	lb.
Two-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Wayward 6th B No. 1	G. S. Young, West Plains	6 349	350·0	365	11 404·8	536·50

Red Poll Class Averages.

The average production of the three Red Polls certificated in 1929—one in the two-year-old, one in the three-year-old, and one in the mature class—was 384·41 lb. butterfat. The averages, class by class,

for all certificates issued to Red Poll cows since the commencement of the C.O.R. testing for this breed in 1918 are shown in the following table :—

Table 14.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	36	343	7,542·4	333·25
Three-year-old	13	346	7,881·1	343·17
Four-year-old*	6	343	9,909·1	425·86
Mature	19	333	10,047·7	427·38
All	74	341	8,437·0	366·67

* No additions in 1929.

Red Poll Bulls.

Three Red Poll bulls have qualified for the C.O.R. class so far. The past year brought no changes to the list for this breed.

Guernseys.

One Guernsey cow, Dominion Flora's Pride, gained a certificate during the year, with 593·29 lb. butterfat from 10,339·4 lb. milk, in 365 days, her age at commencement of test being 3 years 361 days. As the prefix "Dominion" implies, this cow is owned by the New Zealand Government. She was tested at the Ruakura Farm of Instruction, Hamilton, and is the second Guernsey to be granted a C.O.R. in New Zealand.

The friendly co-operation and valued assistance of the secretaries of the various breeders' associations has been continued, and we again desire to make cordial acknowledgment to Mr. W. M. Tapp (Jersey Cattle Breeders' Association); Mr. J. P. Kalaugher (Friesian Association); Mr. A. W. Green (Milking Shorthorn Association); Mr. R. H. Spencer (Ayrshire Cattle Breeders' Association); and Mr. L. J. Wild (Red Poll Cattle Breeders' Association).

Salting of Cheese.—Some experiments on the influence of the method of salting upon changes in cheese have been made in Sweden. It was found that salting immediately after the whey was drained retarded the growth of bacteria, and bacteria in such cheese developed more slowly than in cheese not salted for three hours. The percentage of milk-sugar decreased and the percentage of acidity increased much more slowly in the cheese from the early-salted curds. Curds salted later stood more salt without becoming hard, brittle, and crumbly. One of the Canadian precepts respecting salting is, "Hold the curd until you believe it is ready for salting, and then give it a further fifteen minutes." This practice is conducive to a greater acidity in the cheese without showing in the body of the cheese as excess acid, and is considered to be conducive to greater closeness of body. This is particularly necessary in the warmer months, with their higher temperatures in the average curing-rooms.—*Dairy Division.*

AN ECONOMIC SURVEY OF THE POULTRY INDUSTRY IN NEW ZEALAND.

SUGGESTIONS FOR STABILIZATION.

ACTING under instructions from the Hon. G. W. Forbes, Minister of Agriculture, a comprehensive survey of the conditions surrounding the poultry industry has recently been carried out by the Farm Economics Section of the Department of Agriculture, under Mr. E. J. Fawcett, Farm Economist, and was published in report form at the end of last month. The necessity for such a survey arose owing to the unsatisfactory position of our egg-producers in the 1928-29 season. It was recognized that unless some reform could be brought about producers engaged in the industry must always be liable to the cyclic movement of depression and comparative prosperity which has characterized egg-production during the last twelve years.

The survey analyses the present position fully, covering organization of producers, markets, export, production costs, distribution of poultry stocks, production and consumption within New Zealand, and the importance of the industry to the country. Certain conclusions are arrived at, and suggestions made which are calculated to stabilize production either for local requirements or for export purposes. The following extracts from the concluding part of the survey are reprinted for the information of *Journal* readers :—

Conclusions.

(1) The poultry industry is of considerable importance in the economic life of New Zealand :—

(*a*) The products are a necessity in the family menu and rank very highly in food value.

(*b*) Eggs represent a considerable item of expense in the household budget where they have to be purchased.

(*c*) Poultry can be housed in a confined space, and are therefore kept by approximately 50 per cent. of the householders of the Dominion. In the majority of cases fowls are run primarily to supply the family, and, as scraps constitute the major portion of the feed of small flocks, eggs are produced at a minimum cost.

(*d*) The surplus eggs from side-line and back-yard flocks combined with the output from specialized and semispecialized farms represent a valuable article of commerce.

(*e*) Poultry flocks and plant represents a large capital outlay.

(*f*) Approximately 2,000,000 bushels of wheat, besides large quantities of other grain, pollard, bran, &c., are consumed annually by the poultry of New Zealand, and this has a very important bearing on the wheat-growing industry. The poultry industry affords an outlet for the bulk of the 25 per cent. of the total wheat crops which is classed as other than milling quality, and if this outlet were not available the position of wheat-farmers would be immediately affected.

(*g*) As a side-line to fruit-farming, dairying, and other small-farm enterprises, poultry contributes largely to the net income.

(2) The industry is difficult to organize because—

(*a*) It is carried on by a large number of people who use city markets as an outlet for their surplus production.

(*b*) As birds begin to produce at six months of age, it is possible to procure a greatly increased output in a short space of time.

(*c*) The poultry census is taken every five years, and it is therefore impossible to gauge accurately flock-movements and possible production.

(*d*) Owing to established commercial practice, it is difficult to obtain merchants' co-operation in marketing reform.

(3) The present position of the industry is unsatisfactory owing to—

(*a*) Overproduction, caused through—(i) prohibition of the importation of foreign pulp and imposition of duty; (ii) a consequent and cyclic period of high and low prices; (iii) Government guarantee on exported eggs during the 1928 season.

(*b*) Consequent on overproduction, prices declined on the local market in 1928, the price-level in the flush period being influenced by pulp contracts and carry-over from previous seasons.

(*c*) Despite the drop in price, food costs are maintained at a high level owing to—(i) protection afforded the wheat industry; (ii) lack of producers' organizations with financial backing, thus preventing the purchase of food in bulk direct from wheat producers' organizations; (iii) therefore, when wheat, &c., is bought in small lots the poultry-farmer pays all the cost of transport, handling, insurance, storage, and shrinkage, plus the profits of all middlemen, which at every handling is computed on an increasing value.

(*d*) Owing to lack of organized marketing, the reduction in price is accentuated by the condition in which eggs are delivered to the local trade, especially from small country flocks, where eggs are collected and held for some time before despatch to city markets.

(*e*) The combination of low prices and high feed costs is forcing farmers to reduce flocks during 1929 or go out of the business altogether. Thus capital is being directly lost. The movement of food and egg prices closely correspond. Owing to the reluctance of farmers to lose capital, overproduction has taken place. The price of eggs has dropped more rapidly than wheat prices, giving the impression that it is food costs which are responsible for instability. The present movement of flock-reduction will continue until, owing to restricted production, the price realized on the local market rises to an economic level to meet the costs of production. Thus another cycle will be completed.

(*f*) Owing to this typical price and production cycle the industry must always remain unstable if not properly organized.

(4) The study of farm accounts proves that conditions during 1928–29 were uneconomic on commercial poultry-farms. The surplus, after food costs were met, was barely sufficient to cover overhead expenses. Labour reward of the owner was small or non-existent. During the present season (1929–30) the position is likely to be so bad that side-line flocks will be reduced, in addition to reduction in total flocks caused by commercial farmers selling their plant.

(5) The position cannot be relieved by exporting the surplus, as conditions on the London market are not sufficiently bright to offer a remunerative return. In addition to comparatively low prices in London, the costs of handling and shipping are heavy, leaving a net balance below the cost of production. This loss cannot, under present conditions, be distributed over all eggs sold locally, as export is undertaken by a small proportion of producers only. To make large-scale export possible it is essential that all producers stand their percentage of loss. If a small quantity only are shipped, no stabilization of the local market can be expected.

(6) Preserving, pulping, and chilling of eggs in large quantities may have an immediate effect on the price of fresh eggs, and must react detrimentally during the following season.

Suggestions for Stabilization of the Industry.

Before any attempt is made to reorganize the industry it is necessary that it should be decided whether it is a branch of primary production worth assisting or not. The study of its movements over a long period of years shows that the present position is not new. It is safe to assume that, if left to its own resources, the cyclic movement of prices and consequent prosperity and depression experienced over the last twelve years will be repeated. With every depression a direct loss is made on capital and a disorganization takes place in production. The producer loses directly, but the State loses indirectly.

Any disarrangement affects the commercial farmer first. The specialist is of great importance in maintenance of stock standards, and, although small in numbers, should be encouraged. The most important group of producers are those who do not wholly depend on poultry products for their living, but who rely on poultry to such a degree that great care is taken in management and in the class of product put on the market. It appears desirable that egg-production be continued as a stable industry on side-line farms. To safeguard the industry for this class and for the commercial owner certain regulations are urgently needed.

If the industry is thought of sufficient importance to warrant stabilization, then the following suggestions must receive serious consideration :—

(1) *Export Subsidy.*—The Government subsidy granted for export eggs has not had the desired effect. Prices on the local market have not been stabilized, and, owing to the price received in London, little hope can be entertained that future shipments may be made on a self-supporting basis. Therefore this form of help should not be continued after the current season.

(2) *Poultry Census.*—Owing to the possible rapid movement in poultry-flocks, the present system of taking a census every five years is quite inadequate. It is imperative for the stabilization of the industry that an annual stocktaking be made, so that reliable figures are available. It would then be possible to gauge production and forecast movement of supply and prices from year to year. This would prevent violent dislocation of the industry, and consequent loss of capital. It would also tend to maintain prices at a more uniform level. The method considered most practicable for the collection of data is "That it be made compulsory for all poultry-keepers to submit an annual return as at 30th April, such returns to be made on a prescribed form issued by the Department of Agriculture and available at all post-offices or on application to local officers of the Department. The responsibility of making the return to rest on the individual, a penalty to be imposed for failure to comply Annual tabulation to be made by the Statistics Office."

(3) *Regulations governing Sale of Fresh Eggs.*—Regulations governing the sale of fresh eggs need to be framed for the definite object of ensuring the uniform grading of all eggs offered for sale, both on a size and quality basis. The case for a scheme of grading is detailed in the section of this survey headed "Standardized Grading." The question of compulsion is one which requires careful consideration. The optional scheme in England and Wales is giving excellent results. Undoubtedly a compulsory clause would ensure success, and would be fairer to all producers. A voluntary scheme, with the backing of the Government, merchants, grocers, and producers, would have every chance of success, but it would be slower in operation, and full control of pulp-manufacture and other methods of storage may not be possible at first. It may also be difficult to carry out a sound export scheme to relieve the local market unless all eggs are forced through a grading-store. As an indication of the feeling among grocers in the Dominion, the following resolution, passed at the annual conference of the New Zealand Master Grocers' Federation in February, 1929, is illuminating :

"That this conference urges the desirability of the compulsory grading of eggs, and suggests that, if this cannot be done by regulation, the necessary legislative action be taken to enforce same."

Need of a Standardized Grading Scheme for New Zealand.

The importance of the poultry industry in the economic life of the farming community is undisputed. Any developments which can be made on sound lines is to the advantage of the country as a whole. As an item of staple diet eggs stand very high, and rank close to bread or milk in the family budget. Despite its importance, the egg trade has in the past been the most haphazard and unsatisfactory of any commodity of daily use. If production and distribution is to be placed on a sound footing and the interests of consumers safeguarded, a standard system of grading is the first essential. In discussing grading it must be understood to cover both size and quality. At the present time eggs are sold as "fresh" irrespective of age, condition, and, in most cases, size. Because they are sold in a sealed container (*i.e.*, the shell) it is impossible for the wholesaler, the grocer, or the consumer to buy and sell with any degree of confidence, especially during certain periods of the year. The fault may lie with the grocer, the wholesaler, or the producer. In any case, it is the grocer and producer who suffer, and undoubtedly the latter are to a great extent responsible for the state in which eggs are placed on the market. A great deal of the trouble arises through what are known as "grocers' collections" from outlying country districts, where a few dozen are collected and forwarded to central markets when sufficient have been obtained to make a consignment, the article finally arriving in the main markets in a very doubtful condition. This will always be difficult to overcome, and has led to the statement so often heard that egg-prices are controlled at certain times of the year by the inferior product. The doubtful condition in which many eggs reach the market directly affects the grocer, and it has been proved from records made available in the course of this investigation that grocers show practically no profit on the eggs they handle. They must be kept for the convenience of customers, but are generally considered to be a non-paying line. At the present time a small proportion of eggs are graded for the local market; but it is not fair that careful poultry-farmers should pay for the improvement in marketing, enabling outside producers to profit. If the commercial and semicommercial poultry-keeper adjacent to heavy consuming centres is to be encouraged—and it is to the advantage of consumers that he should be—then a more equable and satisfactory method must be devised to meet the situation. The advantages of a standard grading system in New Zealand would be:—

(1) The consumer would be guaranteed the quality of the article bought, and would pay a price according to the weight of eggs purchased.

(2) The grocer would be handling a uniform and satisfactory article, which would ensure him against loss, and enable him to feature eggs with the same confidence as other produce.

(3) Distributing merchants, agents, and co-operative concerns would operate on equal terms, and be able to give satisfaction to retailers and *bona fide* producers.

(4) Producers who aim to make a living or at least supplement their living by producing a high-grade article would be safeguarded against the detrimental effect of inferior eggs, and a gradual increase in flocks of this nature would result.

(5) The pulping, preserving, and cool storage of eggs would be facilitated, especially the pulping of eggs of otherwise good quality but which affect the sample of fresh eggs if mixed indiscriminately, as at present, owing to their poor appearance.

(6) In the event of export, grading and packings of suitable eggs in proportion to local production would be simplified and the cost reduced.

A Standard Grading Scheme on Voluntary Lines.

Suggestions for the establishment of a standard grading scheme on voluntary lines are as follows :—

(1) A committee to be set up to organize and control all matters pertaining to the scheme ; such committee to be representative of producers, wholesalers, and retailers, with a Government nominee.

(2) The grading of eggs by weight and quality need not be compulsory to commence with. To encourage voluntary grading, regulations as follows should be enforced : (*a*) All graded eggs to be sold in cartons or from boxes clearly marked with grade and quality and the date such grading took place ; (*b*) all ungraded eggs to be advertised and sold as such, and clearly marked in retail shops as ungraded and carrying no guarantee ; (*c*) in the case of graded eggs sold from bulk boxes, or of ungraded eggs, a notice to be enclosed in all packets, stating the nature of the article sold.

(3) Grading-depots to be registered, as in England, but every endeavour to be made to establish central depots in each main centre, such depots to be common to all wholesalers or agents, who would have their own employee to receive, supervise grading, &c., and distribute produce. This would reduce overhead expenses, guarantee efficiency of staff, and reduce costs to a minimum. All grading should be under Government supervision.

(4) Grading-depots should be central, and, if possible, adjoin cool stores and embrace pulping plant.

(5) Chilled and preserved eggs should be stamped and sold as such.

(6) Grades, both for weight and quality, to be as simple as possible compatible with efficiency, and as a basis of discussion those adopted by the National Egg-mark Committee (England) are suggested.

Funds : To initiate the scheme a certain amount of expense would be entailed in propaganda, &c., which would necessitate a Government grant. This could be considered in lieu of any export guarantee which may otherwise be given. Money spent on the organization of local trade would eventually be of greater value to the industry than a guarantee on export of surplus without internal organization. The question of a levy on all eggs graded should be considered, and such levy come into operation as soon as possible.

While suggesting an endeavour to establish a voluntary system, it is considered that compulsion should be resorted to if voluntary co-operation is not forthcoming.

Pulp.

At the present time pulp-manufacture undoubtedly exercises considerable influence on egg-prices both during the flush and short-production periods. Its manufacture on contract at low prices or for speculation demands a low egg-price level. Thus the tendency is for egg-prices during the flush period to be depressed. The holding of large quantities through the winter months tends to decrease the use of fresh eggs by pastrycooks during the late summer and early spring. A carry-over from one year to another constitutes a menace to the industry, and during normal production seasons becomes difficult to remove. Some form of control in pulp-manufacture and disposal is essential for the stabilization of the industry. Eventually any export of surplus should be in the form of pulp rather than eggs in shell.

Committee.

The establishment of a committee as suggested above should be the first step in organizing the industry. The duties of such a committee would embrace—(1) Advising the Government on any matter pertaining to the industry ; (2) drafting of rules and regulations to govern grading ; (3) propaganda to ensure success of any scheme brought into operation ; (4) control of pulp-manufacture, and, if occasion demanded, control of export of surplus products ; (5) registration of grading-stores ; (6) arrangement of finance as advance on eggs or for purchase of food-supplies ; (7) any other consideration which may be expected to stabilize the industry.

A CASE OF OPENNESS IN CHEESE DUE TO YEAST FERMENTATION.

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SAMPLES of cheese in the form of five plugs were lately received at the Wallaceville Laboratory from the Dairy-produce Grader, Napier, showing a very bad type of fermentation openness. This was unmistakably of bacteriological origin, the plugs being honeycombed with large, round, smooth-sided cavities of more or less regular shape.

In the examination of the cheese the usual methods of dilution and plating out were adhered to, and cultures were made respectively from a 1–10,000 dilution on litmus lactose agar, gelatine, MacConkey's neutral red agar, bile salt broth, and Sabouraud's medium for yeasts. All plates

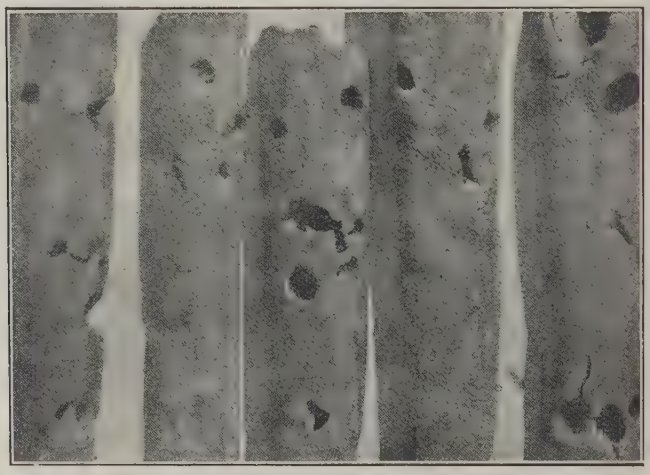

FIG. 1. PLUGS OF CHEESE SHOWING FERMENTATION OPENNESS.

showed the presence of yeasts to a marked degree, including the plate of MacConkey's agar, which may be considered unusual.

The plate of Sabouraud's agar, a medium especially suitable for yeast-growth, was totally uncountable in a 1–10,000 dilution. Examination of a representative number of colonies on this plate showed that the cultural characteristics of most of the colonies selected were similar and typical of *Torula cremoris* and its associated types; moreover, the typical smell (somewhat resembling amylic alcohol) usually present when this type of yeast is grown in pure culture was very noticeable on the Sabouraud's plate.

The transfer of a loopful of the 1–10,000 dilution from this cheese to sterile milk produced a smooth curd, but also showed the large

gas-holes similar to those present in the cheese plugs. Smears from this curd showed the predominance of *Torula cremoris*. In all other respects the cheese plugs showed a normal bacteriological flora, coliform organisms in particular being rather less prevalent than usual.

The cultural characteristics of *Torula cremoris* and associated types of yeasts may be briefly stated for those technically interested, as follows: Smooth plain-edged colonies on Sabouraud's agar, and other solid media suitable for its growth. Cells long, oval, and elliptical; traces of false mycelial growth found in old broth cultures and in the cheese plugs under consideration. (These will be noticed in the microphotograph of the smear taken direct from the cheese—Fig. 3). Vacuols irregular in number. Giant cells occasional. Litmus milk: Acid and gas at 37° C. (The type found present in these cheese slants, and similar types isolated in the past from butter, were also capable of

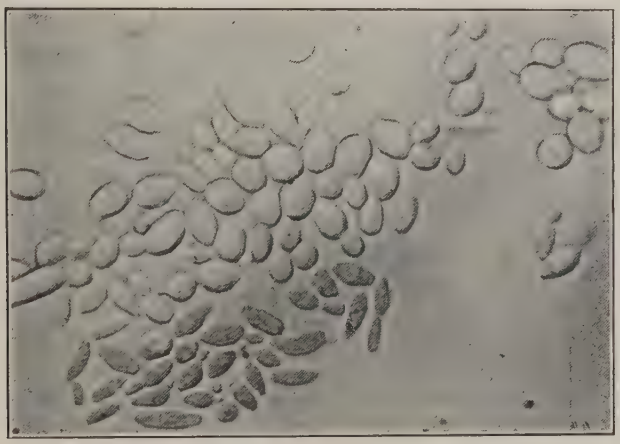

FIG. 2. MICROPHOTOGRAPH OF TORULA CREMORIS YEAST IN HANGING DROP SUSPENSION (UNSTAINED).

developing acid and gas at as low a temperature as 5° C.) Bouillons: Bottom growth. Beer wort gelatine stabs: Gas, but no liquefaction. Sugar reactions of type isolated from cheese (yeast water basis of bouillons): Acid in glucose, sucrose, lactose, galactose, levulose.

Yeasts of the above types have frequently been isolated from routine samples of butter received at this Laboratory, and have been found present in considerable numbers. They have also been found responsible for alcoholic fermentation in old milk-samples that have been allowed to stand for some time. Cultures added to pasteurized milks in experimental cheeses have produced typical cavities in the curd. This, however, is the first time that this yeast has been isolated here from factory cheese and has proved a source of openness.

The microphotograph of a smear taken from a cheese directly from the neighbourhood of these cavities has already been referred to. Fig. 2 is a microphotograph of this yeast unstained and taken by the hanging drop suspension method, showing clearly the morphology of the cells. Fig. 1 shows the two types of cavity produced in the cheeses examined.

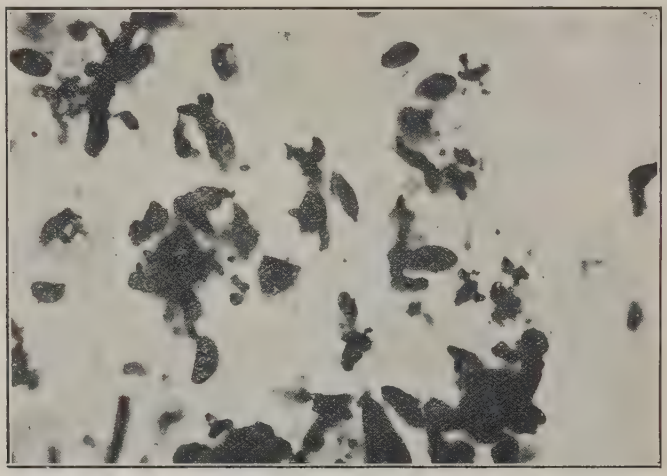

FIG. 3. MICROPHOTOGRAPH OF SMEAR TAKEN DIRECTLY FROM A CHEESE SLANT IN THE REGION OF A CAVITY.

It was intended to follow this matter up from the bacteriological standpoint at the cheese-factory the produce of which was affected. Later advice was received, however, that the Cheese Instructor for the district had visited the factory and that an improvement in the milk-supply had overcome the trouble.

CALCULATING YIELD OF STANDARDIZED CHEESE PER POUND OF FAT.

THE yield of standardized cheese should be calculated on the weight of the fat contained in the whole milk, less the weight of fat contained in the cream of the milk which was skimmed; and the fat in the cream, whether disposed of as cream or made into butter, should be credited to either cream sold or butter manufactured.

This method ensures compliance with the requirements of clause 4 of the Dairy Industry Amendment Act, 1922, prescribing the statement of overruns and yields which are to be furnished annually by dairy companies to their suppliers. Under this clause it is not necessary to take cognizance of the fat in the skim-milk.

—*W. E. Gwillim, Assistant Director of the Dairy Division.*

DISEASES OF DAIRY COWS.

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IV. TEMPORARY STERILITY—*concluded.*

(3) PHYSIOLOGICAL DERANGEMENT.

A physiological derangement of the genital complex may presumably result from many causes, the most important of which are (*a*) pathological conditions arising from infection or otherwise; (*b*) deficiencies in the pasture or the diet, resulting in malnutrition or undernutrition; and (*c*) irrational management and overproduction.

Pathological Conditions.—Infection, as previously mentioned, may have some place in the etiology of temporary sterility, for in many herds experience would appear to justify such a conclusion. A newly purchased cow, a new bull, or a bull which has served cows belonging to a neighbour, has often appeared to bring in "infection," and many farmers are still confident that herein is to be found the sole cause of this temporary failure to conceive. It remains, therefore, to appreciate how infection can bring about the condition without presumably, in the majority of cases, manifesting any trace of pathological change in the genitalia.

In countries where the dairy cows are housed almost half the year breeding anomalies are common, and accordingly infection of one part or other of the genital tract is usually met with. The published figures from America would suggest that infection of the uterus occurs there in about 50 per cent. of cases of sterility, and in almost half of these infection is to be found extending up the uterine tubes towards the ovaries. The deep crypts and folds of the uterine tubes and even the cervical canal are the most favourable situations for infection to find lodgment, and this has proved to be the case. With regard to infection of the uterus or womb itself, it may be said that unless there is a very severe infection over a relatively long period definite changes cannot be produced which might render this organ functionally inactive. Infection may cause a derangement in many ways by favouring a fibrosis with occlusion even, an atrophy or hypertrophy of the uterine epithelium, by calling forth an inflammatory response in the affected tissues. Toxic products of bacterial activity, increased alkalinity or acidity, and even more acute pyogenic processes, may lead to death of the sperms before conception has occurred, or even inhibition of implantation after normal fertilization.

Pathological conditions of the various regions of the genital tract may therefore act more by preventing conception, rather than by directly favouring a physiological functional derangement of the sexual sequence in the cow herself. It must be remembered, however, that in the presence of an endometritis, and depending upon its severity, the occurrence of œstrum tends to become irregular, and more particularly so if infection persists for two or three months after calving. Cervicitis and salpingitis have therefore received more attention with reference to temporary sterility, but exhaustive investigations in many parts of the world have failed to establish any definite relationship.

Deficiencies in the Pasture or Diet.—With regard to the question of a functional derangement, either pathological or physiological, resulting from a deficiency in the pasture or drinking-water, many facts would appear to point in this direction. Firstly, in most cases, beyond perhaps a slight cervicitis or even cystic condition of the ovaries, which do not lead to any interference with the normal sexual cycle, no real evidence of any serious pathological changes have been demonstrated. Secondly, after several unsuccessful matings the cow eventually conceives too late in the season and carries her calf to the end of a normal gestation. Finally, a period of sexual rest, as when a cow is held over till the next season, will suffice to lead to a successful first service. These facts suggest a temporary derangement resulting from possibly a temporary deficiency of some sort, which under New Zealand conditions can only be taken as a deficiency in the pasture or drinking-water.

A deficiency in the soil would of necessity be a permanent one, and a deficiency of the pasture would result, and sooner or later this would be reflected in the grazing animals unless remedied, where the conditions permitted, by the application of suitable soil-dressings. Such conditions exist in various parts of the world, and in others a depletion of the soil is going on, under conditions of grassland farming, where milk, wool, hides, beef, and mutton have been produced and removed for generations without any attempt being made to make good the loss of the essential minerals for plant-growth and therefore animal husbandry. Under such conditions malnutrition and sterility are known to have occurred amongst dairy stock. The possibility of such an occurrence—a progressive depletion of the soil, as apart from an actual soil deficiency—must not be neglected, even in New Zealand, which is a comparatively new country.

This soil depletion and soil deficiency would of necessity lead to more permanent ill effects, but temporary sterility cannot be so classified, since most cows which fail to conceive in the early summer are found to be in calf by February or March. This suggests possibly only a temporary deficiency in the diet of the cow in the spring months, either just before calving or during the months which immediately follow. The normal diet of the dairy cow—that is, grass (and, of course, water), must come under suspicion.

The chemical composition of the pasture varies throughout the year, depending upon the variety of plant species and the stage of growth. The animal grazing freely will instinctively select the herbage to meet its particular requirements, at least as regards the proximate principles, carbohydrates, fats, and proteins, together with palatability; but as regards the mineral elements for ordinary metabolism the supply would possibly not meet the seasonal demand, and systemic depletion would of necessity result. Calcium, phosphorus, and perhaps iodine, as already mentioned, are generally considered of the greatest moment in animal nutrition, or at any rate are the elements which have received the most consideration in connection with the problem of sterility. It is interesting to note from the few figures to hand of pasture-analyses—from one dairying district at least—that there appears to be a sufficiency of lime, but a reduction in the phosphorus content. More extended work in this direction is needed, however, before anything

approaching a conclusion can be reached. From another source the soil iodine for the same area is reported to be as high as in any part of the North Island.

Presumably, calcium may be ruled out as a possible cause of temporary sterility. The question of phosphorus deficiency is an important one, but when one refers to conditions under which an aphosphorosis occurs in bovines it is found that œstrum does not occur, and a persistence of the lutein bodies is met with. Feeding of bonemeal, &c., and also expression of these bodies may lead to conception at a subsequent service. Professor Folmer Nielsen submits definite evidence against the hypothesis that "persistence of the lutein body" is a cause of sterility. By repeated rectal examinations of the ovaries in sterile cows he showed that the lutein bodies disappear and reappear after ovulation, and in many cases without the cow showing any sign of œstrum. Again, lutein bodies cannot be demonstrated more frequently in the ovaries of sterile cows than in normal cows. Finally, lutein bodies can be palpated in the ovaries of normal cows in 100 per cent. of cases, but often only in 75 per cent. of sterile cows, from seven to ten days after œstrum. The obvious conclusion to be drawn from these facts would be that ovulation in infertile cows occurs in less close relationship to heat than is the case in normal cows.

If this interpretation be correct, then a deficiency of phosphorus appears to lead to a derangement of the temporal relationship of ovulation and œstrum. In extreme cases of aphosphorosis malnutrition results, and of course sterility, without the regular occurtence of œstrum. In less extreme cases, it is feasible to assume that a temporary or even slight permanent deficiency of phosphorus in the soil may lead to temporary sterility, without clinical evidence of malnutrition or suppression of œstrum.

With reference to the soil iodine, which appears to be adequate in areas where temporary sterility is common, it must be remembered that a high iodine content is not reflected in the pasture till late in the season; in fact, the early spring growth is relatively low in iodine. Thus at the time when the animal requirements are high and the systematic depletion is greatest there results a definite deficiency, which, of course, is only of a temporary nature.

In this connection it is necessary to take into consideration the amount of iodine which the animal is likely to get in the drinking-water, for should the iodine content of the latter be relatively high the obvious temporary deficiency in the pasture would be necessarily counteracted. The iodine content of river-water from formations rich in lime and magnesium has been found to be relatively low, and snow or glacier fed rivers are notoriously deficient in iodine, more especially so during the melting of the snow. Hercus, Benson, and Carter give figures for three South Island rivers rising in the Southern Alps as nil, 1 gamma*, and 2 gammas of iodine per litre respectively. More recently Shore and Andrews found that the iodine content of upland surface water in the Taranaki region varied from 0·45 to 0·75 gamma of iodine per litre. This was the lowest figure obtained in a recent survey of iodine content of potable waters in the North

* A gamma (γ) equals one-millionth part of a gramme.

Island. It is interesting to find that artesian well-water is ususally very high in iodine. The water-supply of Taranaki is chiefly derived from Mount Egmont, and this would naturally account for the relatively low iodine content of same. The relationship of iodine to the activities of the thyroid gland, and indirectly its action on the genital organs, was discussed in the first part of this article.

It is interesting to learn that in 1924 Stiner, while experimenting with iodized salt on milch cows, observed that his control cows had to be served twice or three times before pregnancy resulted, whereas as a rule one service was sufficient in the cows fed on iodized salt.

Another point of interest in connection with top-dressing of pastures deficient in iodine is that many samples of both basic slag and superphosphate have been shown to contain no iodine; in fact, the amount present appears to vary with the source of orgin. These facts have been established by Hercus, Benson, Carter, and Roberts in New Zealand.

Although the information submitted would appear to favour the hypothesis that a deficiency of iodine, even of a temporary nature, is a cause of temporary sterility in bovines in New Zealand, it must be understood that the problem is far from solved, since many other factors find an equally important place among the statistical evidence now being amassed from herd records. At the same time, the iodine metabolism in animals is still imperfectly understood, and also, what is of greatest importance perhaps, the effect of iodine on calcium and phosphorus metabolism. A deficiency of both iodine and phosphorus may supply the explanation of many cases of temporary sterility.

With regard to the possibility of a deficiency of the anti-sterility vitamin E, which has recently been discovered, it is feasible to assume that such may occur in cows which are suffering from malnutrition from pasture deficiencies, or undernutrition on account of irrational management. A complete systematic depletion of vitamin E is hardly possible, whereas an excess of this accessory food factor in the succulent spring feed could possibly bring about the condition when pregnancy may not occur. Sufficient evidence is not yet available to warrant a definite opinion regarding the importance or otherwise of this vitamin.

Undernutrition resulting from irrational management will be more easily discussed under the next heading.

Irrational Management and Overproduction. — High individual production has been recently cited as having an important bearing on temporary sterility, but although a considerable amount of valuable material is available from the herd-testing records no definite pronouncement is yet possible.

Official statistics show that the dairy-cow population of New Zealand has increased by about 65 per cent. during the last ten years, and also that the increase in butterfat-production has been particularly rapid during the same period, amounting to approximately 130 per cent. It is significant also that there has been over 600 per cent. increase in butterfat-production during the last thirty years. This increased production has been due to the rapid increase in dairy stock, a grading-up of same,

a marked improvement in grassland farming, and an increasing practice of top-dressing. The production per cow has increased by some 80 per cent. in the last thirty years.

In the earlier days of settlement the natural fertility of the soil would appear to have provided the necessary material for the relatively low-producing dairy stock, but altered circumstances called for improved methods of dairying, and top-dressing was the outcome. How far a continuance of existing methods are possible is very difficult to say, but it can readily be appreciated that it will become more difficult and necessarily more expensive to maintain this steady improvement. It is therefore feasible to assume that in some districts and on some farms the limit has been reached. Many farmers have realized the situation and have provided in advance for the changing conditions, and winter feeding with hay, supplemented where practicable with roots, is becoming more and more a regular practice.

It can be accepted that innutrition during the winter months, just at the time when great demands are being made upon the pregnant animal, is bad and likely to exert a considerable influence in the incidence of temporary sterility. When individual production is being pushed by culling and breeding according to authentic milk-yields the nutritional requirements of the dairy stock must necessarily be attended to also. More than a decade or so ago the cow was capable of deriving the essential constituents for normal metabolism and production, but the high individual butterfat tests now recorded would call for different management. Recent figures from the best dairying districts indicate that the herd averages have rapidly increased. In many cases this may be by judicious stocking and liberal manuring, but it is only recently that attention has been focussed on production per acre as the only economically sound policy for the future. High individual milk and butterfat yields assuredly lead to a systematic depletion, unless the increased requirements for greater milk-production are met in some other way.

The management of the dairy stock is important, and on many farms leaves much to be desired. The present practice or aim is to calve practically all the cows during July and August, but owing to the incidence of temporary sterility in the herds it is found, for example, that not more than 60 per cent. of the cows in Waikato district calve before the end of August. With the increase of temporary sterility in a herd more cows come in late each year, and the tendency is for these cows to be put to the bull earlier than would otherwise have been the case. The same naturally applies to the heifers, for calves from late-calving cows will be mated younger than would otherwise be the case, in order to calve down in July or August when perhaps only twenty-one months old. This practice, necessitated by late calving resulting from delayed conception is economically unsound, for the loss in future production and the risk of physiological derangement of the sex organs are too serious to be discounted. Many farms experience difficulty in getting the heifers in calf without repeated services. Here the reason may be twofold—firstly, breeding when too young, as already stated, and, secondly, improper management of the young stock, which ought to be looked upon as the basis of the future herd. These followers must be well cared for, and perhaps more so than the cow which has already come into profit.

There is always a tendency for dairy-farmers to favour early calvings in order to utilize to full advantage the spring feed right up to the summer dry conditions. There is something to be said for this system, which is useful after open winters, but obviously bad in backward springs. In other words, the seasonal variation limits the farmer to an overabundance of green food during a relatively short period, and a corresponding shortage of forage at other times. Silage will meet the herd requirements during the summer dry spell, but only winter feeding with hay, supplemented where practicable with roots, will ensure a satisfactory start for the milking-herd, following early spring calvings, even when feed conditions are otherwise favourable.

Very early calvings may give the long milking-period, but the risks attending such practices will manifest themselves in other ways, and temporary sterility may be the most costly to reckon with.

The Bull as a Factor in Temporary Sterility.

Before concluding this survey of the situation regarding temporary sterility it will be advisable to consider what influence the bull may have on the incidence of the trouble. This may with advantage be discussed under two headings—firstly, the effect of an infection or other pathological change on fertility, and, secondly, the possibility of a temporary physiological derangement resulting from deficiencies in the diet or even irrational management.

Infection or Pathological Conditions.—These may act directly on the bull, preventing normal coitus, or, where service appears to be successful, inhibiting spermatogenesis or causing the death of healthy sperms at or immediately following coitus. Again, infection may not necessarily render the bull infertile, but may be passed on to the female, when she will become sterile. Inflammations in various parts of the male genitalia have certainly been very often met with, but unless these are severe and long-standing, with resulting pathological changes, it is hardly feasible to assume that mild inflammations can interfere with the normal functions and power of reproduction in the bovine species. One need only appreciate the many acute venereal diseases met with in the lower animals which, in spite of very severe manifestations, rarely lead to sterility. Certainly in a herd where all the cows are returning to the bull it is possible that the bull is incompetent, and cases have been found where such infertility can explain the reason why conceptions have not occurred. Another bull generally manages to prevent further returns, but on many New Zealand farms this is not the case, and 100-per-cent. sterility is the exception to the rule.

One would presuppose that infection had been passed on to the cows, which are able to throw it off in the course of two or three months, when conception is possible; again, a sexual rest till the following season will act in the same manner. Evidence has been brought forward to show that contamination of the new bull has resulted after service of the "infected" cows. Sufficient statistical evidence is not yet available to warrant an acceptance of this hypothesis, since the possibility of the second bull being already infertile cannot be overlooked. The fact that probably some 50 per cent. of the cows in a herd conceive at the first or second service

would appear to negative the assumption that the infertility rests with the bull. Further, on most farms the same bull is able to get all cows in calf by the late summer.

Temporary Physiological Derangement.—This aspect of the problem would appear to offer much useful information which might have a direct bearing on infertility. Deficiencies in the pasture may lead to a temporary physiological derangement of function, and more especially so at the time of the year when the bull is required to furnish 100 per cent. successful services in the short period of six weeks to two months. As has been discussed in connection with the female, the diet of the male may be far from satisfactory at least as regards the requirements for fecundity. An 80-per-cent. success is generally accepted as a reasonable estimate of first-service conceptions, but in herds with contagious abortion, where service follows too soon after parturition, the percentage would possibly be much lower.

Professor Folmer Nielsen has offered several interesting facts concerning the male as an etiological factor in sterility, which are worth recording. Excluding those cases where the male is manifesting a demonstrable genital or extragenital disease, and considering only the clinically normal male, Nielsen submits evidence, confirmed also by Saunders in England, that in stallions, and in males generally, the animal is neither fertile nor sterile, but that there are periods of both low and high fertility governed by factors as yet very indefinitely known. Stallions which have always been healthy and have mated normally have been known to vary from 10 to 60 per cent. fertility over a period of years, with a drop from the maximum to the minimum and back again to the maximum.

Overcondition and lack of exercise are well-known causes of reduced fertility in the male, whereas malnutrition and excessive use are equally important. The position may be summarized by stating that apparently normal males vary among themselves, and the individual animal may also vary from season to season, month by month, and even day by day. The cause of this variation will probably not be demonstrable, but it would appear to be physiological and not pathological.

Spermatogenesis may proceed at a variable rate, and the conservation of the power of fertilization may also vary, so that a definite number of services may lead to infertility in one animal more rapidly than in another. Valuable information regarding the intensity of spermatogenesis may be obtained by several test matings in rapid succession, whereas the estimation of the spermatozoa—their viability and morphology would give much useful data regarding the incidence of diminished fecundity in the bull. An intensive study of the part played by the bull in herds suffering from temporary sterility has been recently undertaken by the research officers of the Department of Agriculture in New Zealand, but detailed information of the findings is not yet available.

Conclusion.

Before concluding this survey of the problem of temporary sterility the writer would wish to state that many facts here submitted are not

necessarily conclusive, since the whole subject is a very intricate one, with many ramifications, commanding the attention of specialists in various fields of science. Chief among these may be mentioned those specialists in animal husbandry, economics, physiology, bacteriology, and pathology. At the same time the writer, without wishing to submit a definite hypothesis, has attempted to present an unbiased interpretation of the data at present available in America, Europe, and New Zealand. It must therefore be appreciated that not one factor merely, but many, will be found to account for the condition grouped under the one title of "temporary sterility."

The percentage incidence of sterility, and the regularity of the recurrence of œstrum in the individual members of the herd, are perhaps the most important points to consider when seeking an explanation of the "returning to the bull"; whereas the blame may finally rest on the bull, the cow herself, or the pasture and diet generally. Irrational management, which of course cannot be overlooked, has in certain herds been proved to be the cause of the trouble. In this connection may be mentioned too early calvings, breeding when too young, failure to supplement the feed under certain conditions, excessive use of the bull, indiscriminate interference as affecting sex hygiene, and, finally, soil-depletion as reflected in the dairy stock.

In concluding this series of articles on the Diseases of Dairy Cows the writer wishes to express his indebtedness to his colleagues in the Department of Agriculture for many helpful suggestions and for their valuable assistance, willingly given, in various directions. A considerable amount of very valuable information has been placed at the writer's disposal, and without these data a complete survey of the situation, embodying the large volume of work already done in New Zealand, would have been impossible.

CARBONATE OF IRON FOR BUSH SICKNESS.

In the *Journal* for April, 1929, page 233, reference was made to an iron carbonate, known as spathic iron-ore, occurring naturally in Auckland Province, which was being tried for the treatment of bush sickness in cattle. Since then the experimental use of this material has been extended and found to give excellent results, so that a certain group of farmers are anxious for further supplies. Arrangements have therefore been completed whereby a regular supply is assured. The finely powered iron-ore may be mixed with an equal weight of coarse agricultural salt, and the mixture given as a lick to cattle. The experiments have been successful hitherto with milking-cows and calves. The Chief Chemist, Department of Agriculture, P.O. Box 40, Wellington, will be glad to hear from any farmers in the bush-sick areas who wish to experiment with this new remedy.—*Chemistry Section.*

SPARTINA TOWNSENDII.

A VALUABLE GRASS FOR RECLAMATION OF TIDAL MUD-FLATS.

(Concluded from November, 1929, issue.)

H. H. ALLAN, Systematic Botanist, Plant Research Station, Palmerston North.

2. Experience in New Zealand.

The introduction of *Spartina* into New Zealand was recorded by the writer in the *New Zealand Journal of Science and Technology* for November, 1924, as follows: "In 1913 a number of plants of *Spartina* were obtained by Mr. K. W. Dalrymple from Southampton Water and planted out in small clumps on the Foxton mud-flats in the tidal estuary of the Manawatu River. The clumps were considered to consist of specimens of both *S. stricta* and *S. Townsendii*, but unfortunately it is not certain that the latter has established itself. All the clumps that have flowered have proved to be *S. stricta* (this identification being confirmed by Professor Yapp, and at Kew). It may be, indeed, that no *S. Townsendii* was planted, but a close watch is being kept, and any occurrence of this species will be recorded. The clumps were put in bare mud below high-tide level. One clump has thriven markedly. By 1915 it had formed a dense mat 1·8 m. across. The area was again visited on 11th February, 1923, when the patch was found to measure 12·8 m. by 7·2 m. The sheet was dense and short in the central portion, which was becoming mounded by accumulation of mud, and luxuriant on the margin of the deeper tidal channel. There were a few flowering culms that proved the clump to be *S. stricta*. On the 16th March, 1924, the patch had increased to 14·3 m. by 7·4 m., the longer diameter parallel to the tidal channel. Some slight progress had been made towards crossing the channel, here about 1 m. below high-tide level. This patch and several of the others were then flowering rather freely, especially towards the margins." Additional information has since accrued, and is here recorded.

IDENTITY OF THE SPECIES ESTABLISHED AT FOXTON.

Misled by the short growth of the greater part of the main patch, I had concluded that this was made up of *S. stricta*. The late Professor Yapp examined specimens and agreed with this determination. He forwarded the specimens to Kew and received confirmation of this identification. Later on specimens taken from the more vigorously growing portion were sent to Professor Oliver, who determined them as *S. Townsendii*. Dr. Stapf thoroughly agreed with this view, and also examined the original specimens forwarded, finding them also to be *S. Townsendii*. In the meantime Dr. J. P. Lotsy had visited the area with me on 9th May, 1925. He considered the plants to be definitely not *S. stricta*, but hesitated to pronounce them as *S. Townsendii*, as they lacked the characteristic luxuriance of that species in Great Britain. At the time of his visit the more luxuriant portion was still under water and could not be properly examined. Close examination of all the patches has since shown that the plant

established is *S. Townsendii*. Only in one patch is there a bunch of what may be *S. stricta*, if it is not the same as the special bunches in the main patch described farther on. This, however, has not so far been observed to flower.

FIG. 1. MAIN PATCH OF SPARTINA TOWNSENDII BECOMING UNCOVERED BY TIDE. PHOTO, MAY, 1924.

The short growth of the mounded portion is to be noted. *Juncus* had not at this date invaded the patch.

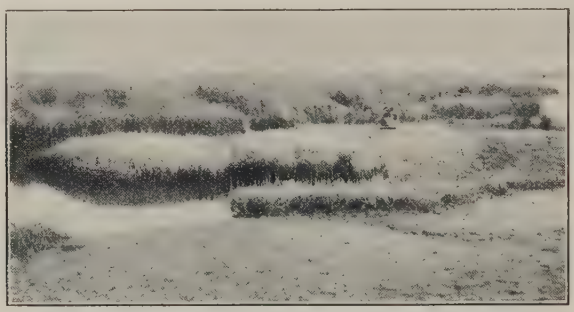


FIG. 2. MAIN PATCH OF SPARTINA, JANUARY, 1930.

Showing raising of level by accumulation of mud. Established clumps of *Juncus* on right.

[*Photo by K. W. Dalrymple.*

On the occasion of Dr. Lotsy's visit I planted out on a piece of soft mud three small clumps taken from the centre of the large patch and representative of the short dense growth there shown. These clumps were placed in line near a shallow side drainage-channel at 3 ft. apart. Their places in the main patch were filled with luxuriant

marginal clumps. A few clumps were also planted out on a much higher and firmer piece of bare mud-flat, but these did not survive. A specimen of *S. stricta* that had been kindly sent out by Professor Oliver, and which arrived in very fair condition, was also planted out in the softer mud. This unfortunately was washed out by the scour before it had established itself. In their new situation the three short-leaved clumps grew luxuriantly, while those that replaced them in the main patch gradually lost vigour and became indistinguishable from the surrounding growth.

In the main patch are two or three small bunches closely resembling the bunch that I have suggested may be *S. stricta*. These were noticed in 1923, and have increased very little in area since that date. They are at once distinguished from the rest of the patch by the almost erect, rolled-up leaves. They have flowered this season, and, as the following table shows, possess characters closely approximating to those of *S. stricta*. A difficulty that has been felt as to the hypothesis that *S. Townsendii* is really a first cross between *S. stricta* and *S. Townsendii* is that the seedlings of the latter show no evidence of segregation. This is surprising if, as Oliver ("Spartina Problems," *Annals of Applied Biology*, vol. 7, 1920, p. 29) says, "as seem almost certain, it is largely propagated and spread by seed." While non-segregation does not absolutely preclude the possibility of *S. Townsendii* being a first-cross hybrid, such cases are quite uncommon. The clumps here discussed certainly suggest strongly that segregation may occur to a greater extent than has been suspected. The offspring more closely approximating to *S. stricta* would tend to be crowded out and suppressed by those more closely approximating to *S. Townsendii*, unless, as in the Foxton patch, the growth of *S. Townsendii* is checked for any reason. It is impossible to say whether these *stricta*-like bunches are seedlings from the *Townsendii* or are the original clumps planted as *S. stricta*. Certainly in the vegetative state there is little to differentiate them from *S. stricta*.

—	*S. stricta* (Herbarium Specimens).	Suspected Segregate from *S. Townsendii* at Foxton.	*S. Townsendii* at Foxton.
Culms	± 45 cm. long	± 55 cm. long, close together	± 70 cm. long, more distant.
Leaf-blades ..	± 20 cm. long, ± 5 mm. wide at base; coriaceous, strict, erect, convolute, pungent-pointed, polished	± 20 cm. long, ± 7 mm. wide at base; coriaceous, strict, ascending at a narrow angle, *convolute, terete in outline*, pungent-pointed, polished	± 25 cm. long, ± 9 mm. wide at base; less coriaceous, ascending at wider angle, drooping at tips, flat or very slightly inrolled, subpungent, hardly shining.
Panicle	± 15 cm. of 2 to 3 spikes, ± 6 cm. long	± 15 cm. of *2 spikes*, ± 12 cm. long	± 30 cm. of 4 to 9 spikes, ± 17 cm. long.
Lower glume ..	± 15 mm. long, linear, acuminate, very silky—hairy	± 15 mm. long, linear, *acuminate*, silky—hairy	± 12 mm. long, linear, obtuse to subacute, less silky—hairy.
Upper glume ..	± 20 mm. long, linear—lanceolate, bifid, awn-tipped, keel scabrid	± 20 mm. long, linear—lanceolate, *bifid, awn-tipped* or nearly awnless, keel somewhat scabrid	± 18 mm. long, narrow—lanceolate, not bifid, acute to almost acuminate, awnless, hardly at all scabrid.
Rachis	Just protruding beyond last spikelet	Protruding for ± 1 cm. beyond last spikelet, practically straight	Protruding for ± 2 cm. beyond last spikelet, flexuose.

FIG. 3. MAIN PATCH OF SPARTINA, FEBRUARY, 1930.
Showing luxuriant growth at edge of drainage channel.

FIG. 4. PATCH OF SPARTINA ESTABLISHED FROM THREE CLUMPS PLANTED OUT IN MAY, 1925.

Showing surrounding *Juncus* association. Advancing edge of main patch on right. Photo, February, 1930.

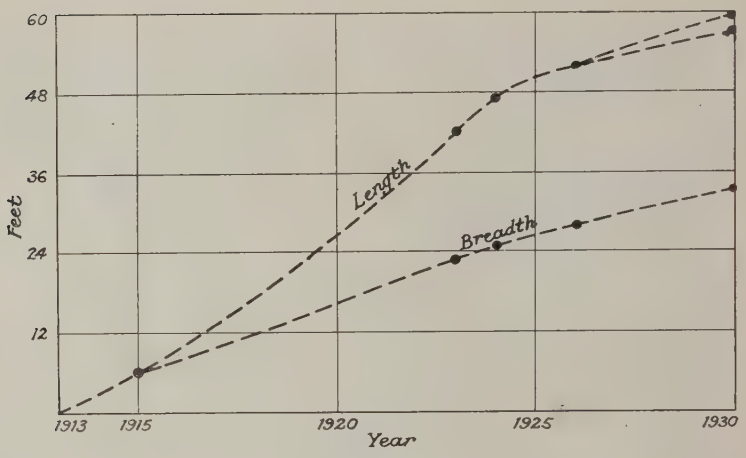
RATE OF GROWTH AND ESTABLISHMENT.

The main patch was remeasured on 22nd November, 1926, showing then a length of 52 ft., with a breadth of 28 ft. On the seaward side it had almost reached the *Juncus maritimus* association, while on the landward it was still held up by the side drainage-channel. Measurements taken on 22nd February, 1930, gave 57 ft. for the length and 33 ft. for the width. The patch had then extended round the shallower end of the side drainage-channel for about 3 ft. Growth along the edge of the main drainage-channel was very luxuriant, but the grass had not succeeded in crossing it. The banking-up of the channel by the grass has caused increased scour and deepening, and in places it was evident that the bank had been undermined and clumps of the grass carried away. One clump had established itself farther down the channel near the point where it reaches the estuary waters. On the seaward margin the patch had joined the *Juncus* association. The marginal growth on the side more remote from the channel was much less vigorous. Here the grass is submerged for only a short period per tide, and the mud is of a much firmer consistency, the feet hardly sinking in at all as one walks over it.

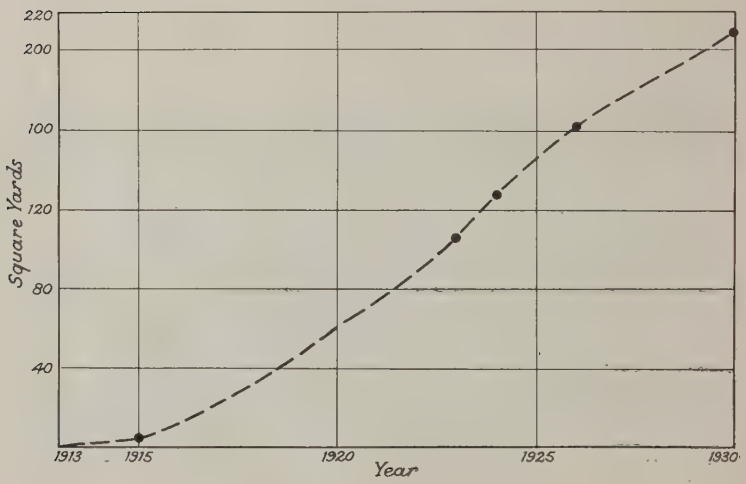
As will be seen from the accompanying graphs, the growth is fairly comparable with that recorded for Great Britain—from 2 ft. to 3 ft. per annum. But there has been no sign of increase by seedlings, and only small increase by detached clumps. In the seventeen years since planting the main patch has grown to roughly $\frac{1}{24}$ acre. All the original clumps show considerable increase, this being more marked in those at lower levels in the softer mud, where too the plants are much more luxuriant. The three clumps taken from the short growth of the main patch in 1925 have made good growth, and there is now a continuous patch of luxuriant grass 18 ft. long by 7 ft. wide. The slackening-off of the rate of growth in the period 1925–30 as compared with that of 1920–25 may be attributed to the barrier opposed by the tidal channel, the higher firmer mud on the further margin, and the competition with the surrounding *Juncus* association.

COMPETITION WITH INDIGENOUS VEGETATION.

In the paper cited I said of the indigenous vegetation of the Foxton mud-flats: "*Juncus maritimus* var. *australiensis* and *Leptocarpus simplex* are dominants, both forming very extensive dense sheets, the latter usually seaward of the former and less in extent. There is not wanting evidence that in this locality the *Juncus* invades the *Leptocarpus* sheets and tends to subdue them. The areas of bare mud are not extensive, and in the *Spartina* neighbourhood border the tidal channels. Between the margins of the dominants and the bare mud there may be patches of *Scirpus americanus*, *Salicornia australis*, or *Triglochin striata* var. *filifolia*, the latter pair with or without other small species. Certain of the *Spartina* patches have now approached closely to the margins of the various species mentioned, and careful measurements and notes have been taken with a view to studying future changes. Present observations suggest that the *Juncus* will take advantage of the raising of the level of the mud by the *Spartina* and invade its territory."



GRAPH 1. SHOWING INCREASE IN LENGTH AND BREADTH OF MAIN SPARTINA PATCH BETWEEN 1913 AND 1930.



GRAPH 2. SHOWING INCREASE IN AREA OF MAIN SPARTINA PATCH BETWEEN 1913 AND 1930.

Subsequent observations show that where the *Spartina* meets the advancing *Juncus* or *Leptocarpus* it penetrates for a short distance, but is dominated and suppressed by both indigenous species. The dense growth of the rush cuts off the light, and at the same time the presence of *Juncus* or *Leptocarpus* shows that the level is higher than the optimum for *Spartina*, while the mud is much firmer than suits *Spartina* best. It would also appear that *Scirpus americanus* is a potential dangerous competitor, favouring as it does muds rather softer than those on which the *Juncus* and *Leptocarpus* flourish. The mounded top of the main patch of *Spartina* has now been invaded by

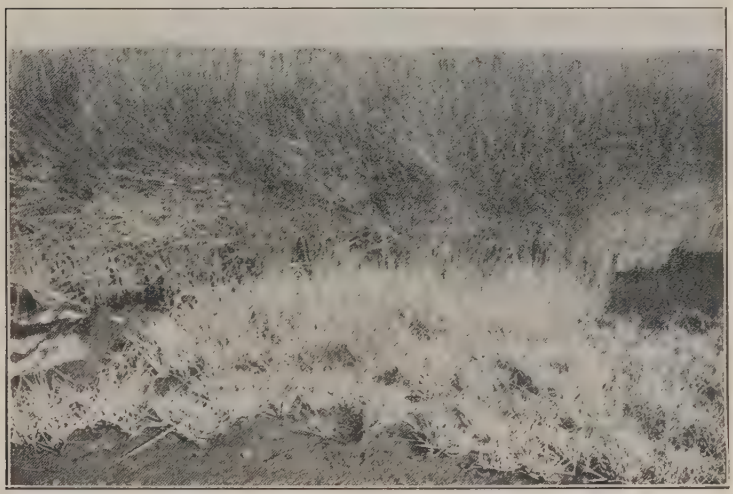


FIG. 5. SMALL PATCH OF SPARTINA COMING INTO COMPETITION WITH ADVANCING JUNCUS.

Juncus, apparently from seedling attack. There are now well established on it five clumps that have reached the flowering stage. Thus the higher parts of the patch appear likely to be dominated by the *Juncus*.

OTHER EXPERIMENTAL AREAS.

Numerous small clumps have been taken by Mr. Dalrymple and distributed for experiment elsewhere. Some of the localities are Kaitaia, Kaeo, Maharau, Kaipara Harbour, Kaukapakapa, Waiuku, Whangarei, Tauranga, Tutaekuri estuary, mouth of Hutt River, and Blind Bay. No definite reports are as yet available concerning the fate of these experiments, but it is hoped to secure and publish such later.

FIG. 6. SELF-ESTABLISHED PATCH OF SPARTINA IN FLOWER, FEBRUARY, 1930.
This patch was not in existence in 1926. Further patches are visible up channel.

CONCLUSIONS.

(1) *Spartina Townsendii* has definitely been established in New Zealand at Foxton.

(2) The growth during the past seventeen years has been very satisfactory, and the grass promises to play an extremely useful part on mud-flat areas.

(3) The optimum requirements for *Spartina* in New Zealand have not yet been thoroughly established. It is clear, however, that *Spartina* does not thrive in the more consolidated muds, nor above a certain level in relation to high tide.

(4) For rapid covering of an area extensive planting at regular intervals is required, as increase by seedlings appears to be rare, and increase by natural dissemination of clumps infrequent and irregular.

(5) Spartina will not hold its own in competition with *Juncus maritimus* or *Leptocarpus simplex*. Rather it prepares the ground for their more rapid extension. The best field for *Spartina*, therefore, is where there are extensive areas of bare soft mud-flat sufficiently below high-tide level to discourage the entry of *Juncus* or *Leptocarpus*.

REFERENCE.

ALLAN, H. H., 1924. Spartina-grass and its Introduction into New Zealand. *N.Z. Jour. Sci. and Tech.*, vol. 7, No. 4, pp. 253–256.

Gorse Parasite.—The utilization of a new design of breeding-cage by the Cawthron Institute has proved more successful with *Apion ulicis*, and the indications now are that the acclimatization of this gorse parasite, which up to the present has proved very baffling, will be eventually achieved.

ESTIMATION OF MOISTURE IN CHEESE.

METHODS RECOMMENDED BY THE DAIRY SCIENCE ASSOCIATION.

THE introduction of the manufacture of standardized cheese in New Zealand has made the chemical analysis of cheese a question of major importance. The opportunity was therefore taken at a recent inaugural meeting of the New Zealand Dairy Science Association to discuss the various methods of analysis in use in the dairy factories and grading-stores, with the object of finally formulating a method which could be adopted as a standard. As a result of the discussion, and partly on the basis of the figures submitted by Dr. F. H. McDowall, of the Dairy Research Institute (N.Z.), the following procedure was drawn up and approved by the meeting.

SAMPLING.

The distribution of the three chief constituents of cheese — viz., casein, fat, and moisture — throughout a cheese, or throughout the cheeses from one vat of milk, is not uniform, due both to actual variations in the composition of the cheese as taken from the press, and also to the differences in the rate of loss of moisture by evaporation in the curing-room. It is therefore not possible to obtain a representative sample of the make of cheese from a vat by taking one plug from one of the cheeses with a trier. It was agreed that in order to avoid excessive plugging of cheese analysis should if possible be carried out on only one plug of cheese, and that the errors in sampling should be taken into account in a consideration of the analytical results. It was the opinion of the meeting that the standard position of sampling as adopted by the Dairy Division for use in the grading-stores should also be recommended for adoption in the dairy factories—*i.e.*, at a position on the circumference of the cheese one-third of the distance from one end. Not less than 1 in. of the cheese should be returned to the plug-hole.

Figures were quoted showing that a cheese-plug rapidly loses moisture on exposure to the open air, and it was agreed that plugs should be placed, immediately they were drawn, into a tightly corked sample tube or bottle. The tube should be kept in a cool place, away from sunlight, in order to prevent evaporation from the plug on to the side of the tube, and also running of fat.

PREPARATION OF SAMPLE.

It was unanimously agreed that a homogeneous sample could be prepared most satisfactorily from a plug of cheese by grinding rapidly to a paste in a glass or porcelain mortar, with subsequent cutting into small lumps with a knife and a spatula, and immediate transference back to the sample tube or bottle. For an accurate determination of the figure for fat in water-free solids it is essential that a homogeneous sample should be used for fat and moisture determinations—*i.e.*, after preparation of the homogeneous sample. *It should be kept in a well-corked bottle.*

A sample so prepared is somewhat difficult to introduce into an ordinary Babcock milk-testing bottle. When such bottles are being used the sample may be prepared by cutting the cheese plug into very thin strips, which are thoroughly mixed before the removal of a portion for determination of fat. The cutting should be carried out rapidly, and during the process of cutting and filling into the bottle the cheese should be handled by means of forceps.

ESTIMATION OF MOISTURE.

The moisture estimation is best carried out in wide flat dishes of nickel or aluminium. Tall dishes of the type used for butter-analysis are not so desirable, since they do not permit free circulation of air over the surface of the cheese, and a longer time is required for complete removal of moisture.

In cases where dishes of approximately equal weight are used the dish must be counterpoised exactly before each estimation. A quantity of about 5 grammes of cheese is suitable. It is considered preferable to weigh approximately 5 grammes for the analysis, and to use a table for calculation of the results from the loss in weight. Such a procedure involves admittedly two subtractions of figures as well as the noting of weights, instead of the method now in common use, where 5 grammes of cheese are weighed out and the figure of moisture content per cent. is obtained by a direct multiplication by 20 of the figure for loss in weight. The association considers that the loss in weight due to evaporation in adjusting the weight to exactly 5 grammes may often lead to inaccurate results.

It is important that the temperature and time of heating be carefully controlled. The greater portion of the moisture should be removed from the cheese at a temperature near the boiling-point of water, in order to prevent occasional loss of fat and curd through spitting. Where only one oven is available heating should be carried out at 100° C. (212° F.) during 1½ hours, and the temperature should then be raised to 115° C. (239–240° F.). The heating should be continued at this temperature for 4–5 hours. It is important that the time of heating should not be either too long or too short. In the one case the loss of weight is greater than that due to evaporation of free moisture from the cheese, and if the heating is not adequate free moisture will not be completely removed. It is not difficult to obtain results which agree closely, but the results may not represent accurately the moisture-content of a cheese if the time and temperature of heating have not been carefully controlled.

An alternative method, where an electric thermostatic oven is available, permits heating of the sample overnight. The samples are heated for 15 hours at 103° C. In this case preliminary heating at a lower temperature is not necessary, since spitting is not liable to occur at 103° C.

After heat treatment the dishes should be allowed to cool before being weighed. The dried cheese solids take up moisture slowly from the air. Hence it is advisable to transfer the dishes from the oven to a desiccator during cooling.

In places where electric power is available the association recommends the use of the Hearson thermostatic electric oven, which permits

the accurate control of temperature. Ovens made from an electric hot-plate and an oven compartment of galvanized iron are not considered suitable.

When the Hearson oven is being used to its maximum capacity the time of heating as above defined may not be sufficiently prolonged, as the dishes cover most of the holes in the oven-trays and prevent escape of water-vapour by restricting the natural circulation of air. Under such circumstances the perforated iron trays should be replaced by wire-netting trays.

—*N.Z. Journal of Science and Technology.*

UTILIZATION OF OCCUPIED RURAL LAND IN NEW ZEALAND.

—	*Year* 1928.	*Year* 1929.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	31,416	31,271
Field crops	1,689,369	1,746,200
Area occupied by residences, outbuildings, gardens, &c.	68,566	73,263
Fallow land	124,187	117,944
Sown grasses	16,871,530	16,855,512
Phormium tenax (New Zealand flax)	66,492	62,704
Tussock and other native grasses	14,091,717	14,131,630
Fern, scrub, &c.	3,976,134	4,016,774
Tree plantations—		
Conifers	200,513	252,052
Eucalypts and broad-leaved trees	31,570	41,849
Standing virgin forest	4,000,683	3,883,805
Barren and unproductive land	2,303,277	2,309,117
Totals	43,455,454	43,522,131

In this table "barren" land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. The table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, while, as shown above, the area occupied in 1929 was returned as 43,522,131 acres—a difference of 22,868,131 acres.

—*Census and Statistics Office.*

Distribution of the Ragwort Moth.—The Chairman's report to the February meeting of the Research Council contained the following reference to this subject: "The Director of the noxious weeds research has been engaged upon the liberation of as large supplies as possible of eggs of *Tyria jacobaeae* to the badly infested ragwort areas. In order to secure the best results the distribution has been arranged through district officers of the Department of Agriculture; and reports to hand indicate that the moth is becoming well established wherever it has been liberated. Unfortunately, supplies of pupæ of *Tyria jacobaeae* received from Farnham Royal have not been in such good condition this year, owing to the unfavourable English summer conditions, and in consequence a lesser number of eggs has been available for distribution than was originally hoped for. The persistent rain that has been characteristic of this New Zealand summer has also delayed progress to some extent."

SEASONAL NOTES.

THE FARM.

Pasture-management.

THE season has been of such a nature that in many districts where a fair amount of autumn rain usually falls it will be found highly advisable to "top" the pastures with the mower during the early autumn, in order to remove patches of long, rank, mature growth. The removal of these patches results in the development of a valuable, even, fresh growth when adequate moisture has been provided by rain. If in early autumn suitable dry stock are available to consume the coarse growth that calls for removal, then the mowing just mentioned can be dispensed with. It is gratifying that more and more farmers, judging by their practice, are becoming convinced of the value of mowing pastures on which stock have failed suitably to control the growth. The proper pruning or cutting-back of pastures, whether it be by animal or mechanical means, will in the future be a most influential consideration on thousands of farms, because it will lessen or remove the necessity of providing high-producing stock with concentrated feeds or special forage crops.

Autumn harrowing of the pastures is a valuable practice which is rightly growing in popularity. At this season harrowing has a twofold purpose. In the first place, it effects distribution of the animal-droppings, which tend to accumulate during the dry summer period in which it is often inadvisable to harrow. These droppings, which, if undisturbed, do injury to the pasture, are a source of valuable fertilizing material when effectively scattered. In the second place, grass-harrowing should be considered and made a form of cultivation. The sooner it is popularly realized that grass, like other crops, responds to cultivation, the sooner will suitably severe harrowing be looked upon generally with favour rather than with misgiving. Up to the present the cultivation generally given our grassland by harrowing has been too light rather than too severe. Grassland is likely to specially respond to autumn cultivation because in the autumn certain valuable pasture species tend to develop a fresh crop of feeding-roots. Surface cultivation, by pulverizing the soil, occasions the conditions favouring vigorous development of these valuable feeding-roots.

Autumn Top-dressing.

Much grassland can very profitably be top-dressed in the autumn. Autumn top-dressing tends to give a greater supply of winter and early spring feed, and to avoid to some extent the excessively heavy growth in late spring and early summer, a growth which on many farms it proves awkward to deal with effectively. Hence, autumn top-dressing tends to beget a more even grass-growth throughout the year; and a more even grass-growth is in many instances a step towards easier farming and cheaper production.

The manures that principally call for attention are the phosphatic ones Of these, superphosphate is the most widely used, and this preference for super is probably sound practice. Super will give successful results where the rainfall is too low for success with the other phosphatic manures, and where the rainfall is high it will on the average quite hold its own with the other phosphatic fertilizers. This is particularly the case on farms where the practice has been adopted of top-dressing each paddock every season. In certain districts splendid results have been obtained with basic

slag. When this is the case farmers should not lightly depart from slag except in a trial way, especially if there is not a great deal of difference between the price of high-grade slag and of 44–46 per cent. super. Provided relatively quick action is not desired, the African and similar phosphates deserve consideration in districts of good rainfall. Under many circumstances a mixture of equal weights of these phosphates and 44–46 per cent. super can be depended upon to give good results on grassland.

It is usually advisable to apply top-dressing early to newly established pastures. The object is to obviate any possible deterioration that would arise from somewhat low soil-fertility. In this connection the wisest attitude to adopt in respect to deterioration is "prevention is better than cure."

Wheat-growing.

For wheat a well-drained soil is desirable, for it allows the natural deep-rooting habits of the crop to be followed. In the cropping system one of the best places for wheat is after peas, tares, or red clover. These crops normally leave the ground in a friable fertile condition, so that a good crop is ensured with a minimum of cultivation and manure. Another favourable cropping order is wheat after rape. After rape the land is easily worked, available at the right season, and the manure applied with the rape may be expected to be of some benefit to the wheat. Growing wheat after pasture is frequently practised, and gives good results provided special attention is given to thorough cultivation. Wheat may also often very suitably be grown after potatoes. These, if dug as soon as they are ripe, will leave the ground clear early enough for the wheat, which can be sown with the minimum of cultivation and yet with excellent prospect of a good crop.

Wheat needs a fine but firm seed-bed. The necessity for firmness sometimes makes it possible to dispense with ploughing after peas or potatoes, the wheat being preceded merely by two or three diskings. It is not desirable to work the surface soil too finely, for the fine particles have a tendency to cake. Small lumps are an advantage, provided they are on the surface; they give the seedlings shelter during the winter and gradually break down into a desirable fine loose surface. When wheat is to follow grass or clover, skim-ploughing should have been done before this matter is published. If not, it should be pushed on with as urgent work. About six or eight weeks after the skim-ploughing it is advisable to disk the surface to a fine condition and then plough to a depth of 6 in. This puts finely pulverized material to the bottom and clods to the top, where they can be broken up suitably with harrows, &c. Especially when the preliminary cultivation is being done somewhat late it may not be advisable to use the spring-tooth cultivator, because of the danger that it may bring to the surface the vegetation that has been buried. By commencing cultivation early enough this ploughed-down grass-growth is given time to decay, to blend with the remainder of the soil, and to contribute to the food-supply of the crop. When wheat is sown after rape, peas, or potatoes the skim-ploughing and the first disking may be omitted. When wheat follows oats or wheat the stubble should be first disked or grubbed, and to obtain a fine tilth should later be ploughed to a depth of 5 in. or 6 in. When wheat follows grass or another grain crop there is always the danger of grass-grub infestation.

In the main South Island wheat-growing areas spring sowing should be practised only when circumstances necessitate it; autumn and early winter constitute the ideal sowing season. In the most southerly wheat areas and in the North Island spring is usually the most profitable sowing-period.

Of the standard wheat varieties, Hunter's, Pearl, and Velvet call definitely for autumn or early winter sowing; Solid-straw Tuscan may be sown

in the spring as well as in the autumn or early winter. In the North Island Jumbuck, Major, and John Brown have won most favour for spring sowing.

Extensive official trials have indicated that over a wide range of country it proves distinctly profitable to use with wheat 1 cwt. of superphosphate to the acre; in twelve Canterbury trials 1 cwt. of super gave an average increase of 6 bushels to the acre, and in no instance was the increase in yield too low in value not to show a profit after paying for the cost of the superphosphate. In Canterbury last season three out of every four growers used manure on wheat at the rate of slightly over 1 cwt. to the acre.

Previous completed official trials over extensive areas suggest that in many instances it will prove profitable to dress wheat in the spring with about 1 cwt. of sulphate of ammonia to the acre. Trials of the past season which are now being completed promise to confirm the spring use of sulphate of ammonia with wheat as a worth-while practice. Attention will be directed to the results of these trials as soon as they become available. There is no evidence to support the autumn use of sulphate of ammonia with wheat when sowing in the autumn.

Control of Cereal Diseases.

One of the wheat-diseases that particularly requires the farmers' attention is covered or stinking smut. When this disease occurs a dark-brownish mass, which sometimes has a strong smell, fills the skin that in ordinary circumstances would hold the healthy grain. Infection of stinking-smut is effected through the disease being deposited on the outside of the wheat-grain. Hence practically any line of seed is liable to become contaminated with the disease, even though it comes from a crop that was free from disease. Every travelling threshing plant is likely to freely spread stinking-smut, and because of this, even when a farmer is saving his own seed from a crop which was free from disease, it will be very advisable for him to take preventive measures.

The best means of controlling stinking-smut is by dry-dusting the seed wheat with fine copper-carbonate powder at the rate of 2 oz. per bushel. This can be done satisfactorily only by those farmers who have a proper dustproof mixing-machine, because the powder is harmful if breathed in to any extent. The dusting is being done by certain merchants who have installed equipment for dealing cheaply with seed in bulk. The advantages of the copper-carbonate treatment is that while it is very effective it involves no danger of injury to the seed, it calls for no handling of wet seed, and it can be done at any time, for treated seed may be kept without suffering damage.

If the copper-carbonate treatment cannot be adopted, pickling with formalin is the next best practice. In the case of wheat, one effective way of carrying out formalin pickling is as follows: Prepare a formalin solution at a strength equivalent to 1 pint of good formalin to 60 gallons of water; wet the seed thoroughly with this solution by sprinkling it over the seed and then shovelling the seed backwards and forwards on the clean floor of a shed. Then pile the seed into a heap, cover the heap with sacks soaked in a formalin solution of the strength already mentioned, and leave the heap covered with the sacks overnight. The seed should be sown while still damp; if it dries out a considerable loss in germination may result. Do not put the treated seed in sacks which may be infected with the disease, but in the sacks which have been soaked in formalin solution.

The following is another effective way of pickling wheat: Prepare formalin solution at a strength of 1 pint of formalin to 40 gallons of water. Have sacks one-third full of seed, and their openings sewn, not tied. For ten minutes immerse each sack in the solution, keeping the grain well agitated in the sack by lifting one and then the other

corner. Then throw the sacks on ground where there is no danger of freezing, and spread the grain evenly by flattening out the sacks. Do this overnight, and the seed is ready for sowing the next morning. The seed cannot be kept long without damage. This and the previously-mentioned method of pickling seed is recommended by Mr. J. C. Neill, Field Mycologist, who advises further that it is necessary to sow about 25 per cent. more seed when the formalin treatment is followed than when copper-carbonate treatment is used.

The second pickling method—the dipping of the sacks containing the seed in formalin solution, 1 pint to 40 gallons—can be used effectively for oats and barley. Very rightly the pickling of seed oats and barley is receiving much more attention than it did a few years ago. Oats-seed should be pickled even though the crop is intended only for the production of chaff. If not pickled, smut will possibly not only cause serious loss of grain, but also discoloration of the whole of the chaff. Despite a common belief to the contrary, Algerian oats are just as subject to smut as other varieties. Barley is perhaps most neglected. It will prove profitable as a general rule to pickle all barley-seed sown—malting, Cape, and Black Skinless.

Bluestone treatment is being generally discarded because of the extent to which it both lowers the seed-germination and weakens the seedlings which do germinate.

General Forage-crop Work.

Arrangements should be made to utilize such crops as maize and millet during April, this being preferably done during the first half of the month. If swedes have suffered a serious attack of dry-rot they should be fed off without unnecessary delay. When barley and oats are to be utilized for green feed, better results are secured by making two or three feedings-off, commencing each when the growth is not very high rather than waiting until there is a tall growth. If the crop is fed off several times when relatively short undue waste by trampling is avoided, and the fodder is better balanced and more attractive than when more mature.

Quite often after the last cut of the season lucerne is grazed and the ground considerably trampled. This practice definitely favours the invasion of grass weeds and is usually inadvisable, especially in districts of good rainfall where the invasion of grass is one of the worst troubles in respect to lucerne.

Oats for winter and spring feed and subsequent grain-production should be sown not later than April or early in May. Generally they respond profitably to an application of 1 cwt. to 2 cwt. per acre of phosphatic manure in which superphosphate is prominent. The proved strains of Gartons may be regarded as the best all-round oat for the South Island. Gartons will not stand feeding off in the same way as Algerians or Duns; they should be fed off once only, and quickly. Algerians, which are best autumn sown, are rightly popular as a green feed; they can be fed off both in autumn and spring, and provide good chaff. Dun oats must be autumn-sown. Usually they make little growth till early September, and then can be fed off several times in the spring.

The initial ploughing of land intended for lucerne and mangels can often advantageously be carried out in autumn, provided the land is not required for some other purpose. By commencing cultivation work early one is often able to destroy many weeds which if not removed would be a danger to the success of both these crops.

When a lucerne-field has become infested with weeds April is an excellent month in which to carry out cultivation to deal with the invaders. If a spring-toothed cultivator is used it should be fitted with narrow tines, otherwise a good deal of damage may be done to individual lucerne-plants

in working the ground enough to dislodge the weeds it is desired to destroy. The use of disks in the cultivation of lucerne is not recommended, because their cutting-action soon results in an undesirable thinning of the plants. It is sound practice under most conditions to follow the cultivation of the lucerne immediately by sowing a bushel of Algerian oats. This sowing of oats with lucerne gives a heavy growth which has a well-balanced supply of nutriment, and which may be made into splendid ensilage in the early summer. It should be definitely planned to make the mixture of oats and lucerne into ensilage, or to use it otherwise early in the season. If the mixture is utilized for the production of hay to be made when the weather is suitable, it is apt to be left unmown so late as to do considerable damage to the lucerne crop by the shading caused by the oats.

—R. P. Connell, M.A., Fields Division, Palmerston North.

THE ORCHARD.

Spraying and Disease-control.

As the crops approach maturity the spray programme will gradually taper off, but the late-ripening varieties will still require attention for mealy bug, red mite, and fungoid diseases. With the dry hot weather red mite will increase rapidly, and trees from which the crop has been picked are often overlooked, allowing this pest, mealy bug, and other insects to continue their depredations and complete their breeding-season without interruption. The consequent loss in tree-energy may be sufficient to cause premature defoliation and adversely affect the next season's growth, as well as necessitating a heavy dormant spraying to destroy the eggs prior to commencement of next season's growth. Judicious applications of summer oil sprays will lessen the number of overwintering eggs, and so reduce the infection that further control may not need consideration until hatching commences in the spring, when a much lighter application will be as effective as the heavy mixtures required for dormant dressings. The practice of applying a fungicide to storage varieties prior to picking has much to recommend it. Black-spot, bitter-rot, and other fungoids will continue their development in storage, and the pre-storage spray may save loss and disappointment in packing out.

Where brown-rot has been prevalent time would be well employed in cutting out twigs or shoots which have been killed by the fungus spreading through the fruit-stalk, girdling the shoot, and forming cankers. These cankers are potential sources of infection during succeeding years, and can be located easiest while the foliage persists. Silver-leaf infection should be cut out before growth ceases, and if taken in time and the diseased portion removed below the infection the life of the tree may be extended. All exposed surfaces should be thoroughly coated with tar or paint as a protection against reinfection by spores. Where the infection is general recovery cannot be expected, and the tree should be dug out and burned. The complete destruction is important, as the spores are produced after the wood has been killed, and any stumps left will be disseminators of the disease.

Picking for Storage.

Fruit intended for storage should be picked as it attains the necessary degree of maturity, care being taken to leave those fruits which are backward in condition for later pickings. The necessity for careful handling cannot be overemphasized, for rots will develop in damaged skin and endanger neighbouring fruit. For home storage where space is limited and

close stacking in cases is necessary it is advisable to segregate each variety, so that their order of ripening can be checked and each used as condition demands. Laths placed between the tiers of cases parallel to the draught will improve the air-circulation and aid the dispersal of gases thrown off during the ripening process. Free circulation of air in the storage-room, which should be kept cool, is important, and excessive moisture is to be avoided.

Preparation of Land for Planting.

This work should be proceeded with as early as possible, in order to allow ample time for soil-aeration before the autumn rains commence. Ploughing in strips about 5 ft. wide and two furrows deep where the tree rows are to stand will be an advantage; the remainder of the land may be left for working in the usual routine if desired. Where the subsoil is retentive it is essential that the ploughing should follow the fall of the land, so as to remit the free drainage of excess water from the root area, and the work can be done more satisfactorily while the soil is comparatively dry than when wet. Early preparation is conducive to early planting, and as root-development commences prior to movement in the top it follows that the stimulation of the early root movement will hasten the establishment of the tree and ensure satisfactory growth during the first season.

Citrus Culture.

This period, while the crop is developing, is a good time for general overhaul of the trees, thinning out exhausted wood, cutting out suckers or water-shoots, and trimming the lower fringe to raise the foliage to about 18 in. above the ground. It may be necessary to remove banked-up soil from round the trunks to minimize the danger of collar-rot. The trunk should be exposed to the normal level, and the soil removed over an area sufficiently wide to avoid the possibility of forming a basin which would hold water and produce conditions inimical to the health of the tree. Citrus-trees are impatient of wet conditions, and any low areas from which surplus water does not drain rapidly should receive attention, either by laying a permanent drain or by opening furrows between rows and providing ready escape for the water.

If necessary, spraying for scale-control, using oil 1–60, should be completed before growth ceases. Oiling when the trees are dormant or in a sickly condition will result in defoliation. Oranges may require an arsenate-of-lead spray to control caterpillars. Citrus brown-rot infection may be expected to appear when the autumn rains commence, and bordeaux, 4-4-40, should not be neglected. The infection from this disease is upward from the ground, and many growers are content to spray only the lower 6 ft. or so of the tree, but the application must be thorough, and later applications after rains are advisable.

Cover-crop sowing should not be delayed, and any quick-growing leguminous crop which will make a good bulk of growth is to be preferred. A dressing of manure to stimulate growth should be applied at the time of sowing. If sheep or pig manure is obtainable a liberal application will be beneficial, but it should be applied in the vicinity of the outer fringe of the foliage and not heaped around the stem. Some discrimination is required in the use of cow-manure. In some localities it is not uncommon to find the soil reduced to an adhesive soggy mass, and the trees slowly dying through the too liberal use of fresh manure. All animal-manure should be well rotted before use.

—*G. H. McIndoe, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Right Housing and Exercise for the Pullets.

FRESH eggs usually command their highest level of value during the month of May. The present position of the market indicates that the forthcoming first months of winter will be no exception to this rule, as the great majority of the adult birds will be undergoing the moulting process and be in an unprofitable condition, and the pullets must be principally relied upon for the egg-yield. In anticipation of cold winter weather, when everything is against a bird producing to its fullest capacity, it only stands to reason that the pullets must be provided with the best conditions if eggs in good numbers are to be secured.

The first essential in this respect is to make the young birds comfortable, as only in this condition can they be expected to do their best. This implies a roomy house, with an open or partly open front as the means of admitting sunlight and fresh air—those great essentials to the well-being of the domesticated fowl. There must be no cracks in the sides or back walls, as these create a draught and cause roup and other troubles. With the open or partly open-fronted house the birds can be fed inside in comfort during bad weather. Obviously a bird cannot be expected to lay well if compelled to wait about in a muddy yard with wet plumage for its evening meal to be thrown down. By feeding the birds in the house a dual form of economy is brought about. Firstly, only a minimum amount of food will be required to maintain the bird, as when it is fed in the rain body heat to dry it and ward off the cold must necessarily come from the food eaten. Secondly, there is a great saving effected in protecting the grain from sparrows and other small birds. It is safe to assume that on many plants the money saved in this way in one year would more than compensate for the cost of making the houses of sufficient depth to confine the birds and feed them under cover.

Provision for exercise is also essential if a bird is to produce heavily at this period of the year. Hence the whole grain ration should be fed in deep litter, in order that the birds may be kept busy in scratching for the hidden grains. In short, every endeavour should be made to discourage the birds from resting on their perches by day, as this is apt to cause an overfat condition—a state which does not tend towards promoting heavy egg-production. This does not mean that the ration should be reduced in order to check a production of surplus fat. On the contrary, it means liberal feeding, but by a method which ensures that the birds are made to work to secure at least the greater part of their food. In the long nights of the winter months the birds have ample time to rest without doing so during the day. The heavy-laying hen is always a busy bird, and if denied the opportunity of keeping in this condition she will fail to be really profitable.

Prevention of Colds.

I cannot urge too strongly the necessity of taking every precaution against colds, which young birds especially are liable to take at this season of the year. It should be borne in mind that once a flock of pullets becomes affected with colds their egg-yield rapidly declines, and in spite of all that is done for them they will bear an unkempt, miserable appearance. Thousands of winter eggs are lost annually from this cause. Not only this, but colds are the forerunner of roup, and once this dreaded disease gains a foothold in a flock heavy mortality is almost sure to eventuate. The best of all means of dealing with colds is to prevent them. The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dust and dirt adhere In severe cases the discharge will usually be found on the feathers under the wing, owing

to the bird sleeping with its head thereunder. When birds show any of these symptoms they should be isolated at once as a prevention against the trouble spreading. The next step should be to find the cause and remove it, and for this purpose it is a good plan to visit the house by night. It may be found that the ventilation is insufficient, or that there are cracks in the back or side of walls whereby the birds are sleeping in a draught, which undoubtedly causes more outbreaks of cold than anything else. Usually when colds make their appearance the poultry-keeper resorts to one of the many cures recommended for this trouble, and quite overlooks the great essential of first discovering and removing the cause. Obviously, if the cause is not removed the trouble is apt to recur at any time. As to a cure, or rather a means of checking the spread of colds, it is a good plan to place some Condy's crystals in the drinking-water, sufficient to give it a pink colour. For well-developed colds dip the bird's beak into pure kerosene sufficiently deep to cover the nostrils, and hold the bird in this position until it inhales, repeating this treatment on alternate days. This will usually effect a cure, but, as mentioned, if the cause is not found and removed the trouble is likely to recur.

Food Quality and the Ration.

Particularly at this season of the year, when the egg-yield may be regarded as more or less artificially produced, the poultry-keeper should make sure that the food supplied is of the best possible quality, quite irrespective of cost. With any class of poultry it is always poor economy to feed damaged or musty food because it is cheap. Especially is this the case with pullets which are being looked to to produce dear-season eggs. They will simply refuse to eat such food (unless, of course, forced to by hunger), and obviously a declining egg-yield will result. At the present ruling price of eggs it will pay to feed nothing but the best, and as much of it as the birds can consume. There is no danger of overfeeding the laying bird with food of the right quality, provided she is given ample opportunity for exercise.

The morning mash may consist of one part of finely ground good-quality wheatmeal to two parts of bran. This should be made as appetizing as possible by moistening it with meat, soup, skim-milk, &c. When these liquids are not available boiling water should be used. A mash moistened with the latter will be much better relished by the birds than when cold water is used. Feed only what the birds will pick up in, say, twenty minutes. If mash is left before them at all times they will eat this and fail to take the necessary exercise by scratching for the grain ration in the litter, in which there should be odd grains for the birds to fossick for. In the evening, and well before dark, give a full meal of grains, such as equal parts by measure of wheat, maize, and oats. It is always a good plan to give more at this meal than the birds require, as what is left will induce them to scratch and keep busy. If it is observed that one of the grain foods mentioned is being left it should be fed in a reduced quantity. In order to secure a high winter egg-yield a forcing element must also be included in the ration. This denotes highly nitrogenous substances such as meat, meat-meal, milk, &c. If, however, it is observed that ovarian troubles are making their appearance, and that many shell-less or double-yolked eggs are being produced, the forcing diet should be reduced accordingly, as these troubles indicate that the birds are eating more of the forcing-food than is good for them. It goes without saying that if the birds are to do their best sharp gravel grit, crushed oyster-shell, clean water, and a liberal supply of green food should also be provided.

Finally, I would emphasize the great importance of doing everything possible to prevent the pullets bred to lay in winter going into a false moult. This is usually due to insufficient or inferior food, and to

changes in the system of feeding, as well as that common cause change of quarters. Obviously, no experimenting should be attempted, but rather should uniform and regular attention be observed in the poultry-farmers' methods.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Preparations for Winter.

THE time is at hand when it is of paramount importance that proper preparation be made for winter in the apiary. If the colonies are to winter in good order, so as to escape the abnormal losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that ensure successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's flow arrives. Among the most important factors which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection.

Strong Clusters.—It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is often satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering. As a result, unless large numbers of young bees are being raised to take the place of the old stock, the colonies will seriously dwindle in the spring or become a total loss in winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Good Queens.—Next in importance is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the bees attendant upon queenless hives will be greatly diminished.

Ample Stores.—If the beekeeper studies his interests and the welfare of his bees he will ensure that every colony goes into winter quarters with plenty of good stores. This is a most important factor, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely, build up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Protection.—Another important factor in safe wintering is that of protection. This may be provided by housing the bees in good watertight hives, and protecting them by good shelter-hedges or fences. Great winter losses occur every year in this country through lack of attention to the hives, more particularly to the roofs. Leaky roofs are an abomination, and should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. It is safe to state that where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, and also prevent the bees from taking a cleansing flight during the spring months.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Tobacco Crop.

LAST month's notes dealing with handling of the late crop have now a special application while the last of the crop is being harvested. The process of curing is a very delicate operation, and great care and attention is required to turn out good leaf at this season of the year. The leaf is very sensitive to changes of temperature and humidity, and adverse conditions quickly spoil its texture, colour, and aroma. Only by the closest attention to detail now may these qualities be obtained and preserved at their best. To leave well-cured leaf exposed to adverse conditions for even a short time results in serious damage. Its bright colour is lost, and a spongy condition of the leaf is acquired. Also the conditions in the bulking-room must be up to requirements, or the finest cured leaf will be spoiled. A wooden floor that is damp through being near the ground and unventilated has often caused serious loss through moulds developing. The same thing happens when any decayed organic matter is present; the pleasant aroma and flavour is lost and a musty flavour is acquired. As before stated, the room in which the bulks are made must be sweet, clean, dry, and free from sudden changes of temperature. The leaf will then not only retain its desirable qualities, but greatly improve with two or three years of such storage.

Planting of Small Fruits.

Preparation of the land for planting these fruits should be completed as soon as possible, so that the ground may be settled down before planting commences. A good dressing of organic manure should be turned well under, with a dressing of bonedust and basic slag to follow. Black currants prefer a cool moist position, and are best planted 3 ft. to 4 ft. apart in the rows with 6 ft. to 8 ft. between the rows. Raspberries require similar conditions; 1 ft. between the plants and 5 ft. to 6 ft. between the rows is good spacing. Gooseberries and red currants require a more open position, and are best planted 5 ft. to 6 ft. apart both ways. Where plants have to be purchased they should be carefully selected now, and arrangements made for delivery as soon as they are ready for removal—about the month of May.

In the warm climate of Auckland it is said to be inadvisable to plant out strawberries before the month of May, but in most districts it is best to plant them as soon as possible now, so that they may become established

before the cold weather. There is one point of special importance in connection with this subject, and that is the utter futility of planting small fruits in land that is infested with "twitch" or similar bad weeds. It is not uncommon to find this done. The eradication of these weeds is difficult when the land is clear of crops, but it is impossible to do it after planting. They may not then even be controlled, and the result is a serious loss. The mistake is generally made, of course, by people with little experience, but they are usually those who are least able to afford it.

The Market-garden.

In most districts late crops of potatoes and onions should now be harvested; great damage is sometimes done by allowing them to remain after they are mature and a second growth has commenced. Spring-sown carrots also should be lifted before they are spoiled by cracking. Beet, parsnips, and autumn-sown carrots are often allowed to remain in the ground until a favourable market demands them.

During the month of April a piece of good land in a warm sheltered position should be chosen for planting out spring cabbage and cauliflower sown in seed-beds a couple of months previously. This is usually a valuable crop and worth careful attention. To avoid the attack of slugs and other insect pests it is often advisable to destroy them before planting by broadcasting a bait composed of 1 lb. of Paris green and 28 lb. of bran thoroughly mixed in a dry state and afterwards made damp with water. Broadcast lightly of an evening it is a very effective remedy. If this is followed with a dressing of lime, the ground may be marked out and planted with every prospect of success.

Seed-beds of lettuce, main-crop cabbage and cauliflower may be sown now for July planting; they should be sown thinly and the lettuce given some shelter in rough wet weather, or rust disease may be troublesome. In cold districts these sowings would be more satisfactory under cold frames.

Asparagus-plants should be cut down to the surface of the ground, and burnt as soon as the foliage ripens and before the seeds fall. A good dressing of well-decayed organic manure and 3 cwt. of kainit per acre turned in would now be very beneficial. Where new beds are to be made in the spring, commence now by giving the land thorough preparation by cleaning it, giving deep cultivation and turning in a heavy dressing of organic manures or cover-crop. A sandy loam, moist but well drained, is very suitable for extensive planting.

Hedges and Shelter Belts.

This subject is of special interest to all who have to do with gardens or orchards of any kind, as suitable shelter is a wonderfully big factor in successful cropping. The land to be planted should be cultivated and cleaned as a rule, and indeed kept so for a year or two until the plants are established. Plans for this should now be prepared and the ground prepared for planting in May. Poplar and privet, planted alternately and close, makes a most efficient breakwind in rich moist ground; or the privet may be replaced by barberry. For a higher evergreen shelter-belt, *Cupressus—Lawsoniana* or *sempervirens*—planted 2 ft. apart, requires comparatively little attention, and is most satisfactory on average land.

—W. C. Hyde, Horticulturist, Wellington.

Relation of Electricity to Agriculture.—A committee has been specially set up by the Research Council to investigate the possibilities of utilizing electricity to a greater extent in agriculture. At present relevant data are being secured from a wide series of sources, and the position is being explored with a view to the issue of a report in regard thereto as it affects New Zealand.

WEATHER RECORDS: FEBRUARY, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

In contrast to the preceding month, February was very dry over the greater part of the Dominion. The whole of the South Island, with the exception of Puysegur Point, had a low rainfall, the deficiency being greatest in the North Canterbury, Marlborough, Nelson, and Westland Districts. Most of the North Island also experienced less than the average, but a considerable excess was recorded in the east coast portion from Poverty Bay northwards and throughout the Auckland Peninsula. This effect was brought about by a predominance of south-easterly winds which were associated with cyclones passing to the north of the Dominion.

Even in those districts where rain was scanty the growth of grass was well maintained throughout. The effect of the lack of rain was small, owing to the heavy falls in previous months, to the absence of drying winds, and to the cool and somewhat changeable weather which prevailed. Conditions were, indeed, at times, more of a spring than a summer type.

On the whole the month was favourable to all classes of stock. Dairy herds have milked well, and sheep and lambs have thriven in most districts. Reports indicate good crop yields, but the absence of warm sunshine has caused harvesting to be much later than usual. In many districts root crops have done remarkably well, the weather having been most favourable to this class of crop.

The mean temperature was again markedly below normal, for although there were many warm days the nights were invariably cool.

The pressure systems responsible for periods of unsettled weather were mainly cyclonic in form. The Auckland, Bay of Plenty, and Poverty Bay districts experienced considerable rainfall between the 1st and the 5th, while a cyclone was located to the north-east of Cape Maria van Diemen. This disturbance passed rapidly away on the night of the 5th, and from then on to the 13th the dominating influence was a slow-moving, fairly intense anticyclone. Except in the areas and during the period mentioned, fine weather of unusual brilliance was experienced over the Dominion until the 13th.

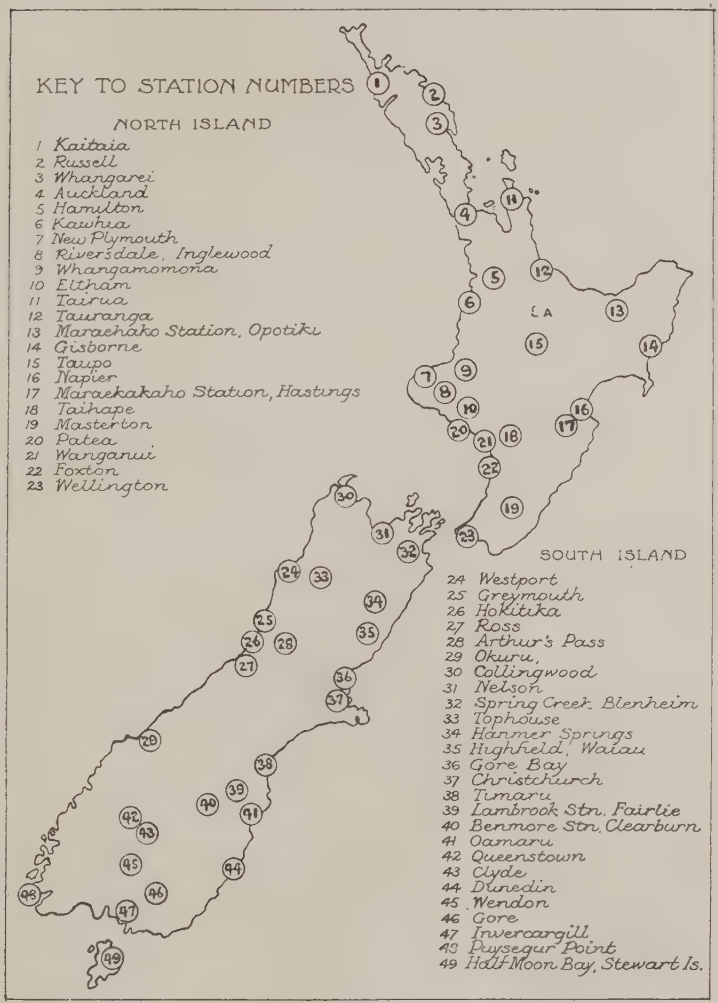
Only two depressions of the westerly type were recorded during the month, one on the 16th and the other on the night of the 23rd. The former followed closely on a cyclone which had moved gradually across the northern Tasman Sea and crossed the North Island during the night of the 15th. Heavy rain was associated with this cyclone in the North Island on the 13th, 14th, and 15th, more especially in the northern and east coast portions, where some flooding occurred at places. The observer at Maraehako Station, in the Bay of Plenty, measured 11 in. of rain on the 15th.

A second very fine spell set in on the 25th and continued to the close of the month. At this time there was evidence of an intense tropical cyclone operating to the north-east of New Zealand. It was too far away to have any general unfavourable effect on the Dominion's weather, but some scattered rain fell in the Auckland and East Cape districts, and on the afternoon of the 28th a severe thunderstorm occurred in the neighbourhood of Taumarunui. A house at Te Koura suffered considerable damage by lightning, the veranda collapsing and the front of the house being scorched.

RAILFALL FOR FEBRUARY, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	6·46	7	5·04	2·95
2	Russell	6·32	7	2·28	3·20
3	Whangarei	6·20	9	2·32	4·46
4	Auckland	6·66	11	3·28	3·06
5	Hamilton	2·47	9	0·98	2·96
5A	Rotorua	2·27	9	0·95	3·85
6	Kawhia	4·38	11	1·23	2·66
7	New Plymouth	2·99	9	0·95	4·00
8	Riversdale, Inglewood ..	5·56	9	1·46	6·30
9	Whangamomona	4·34	10	0·88	4·23
10	Eltham	1·89	7	0·64	3·37
11	Tairua	11·36	10	4·60	4·10
12	Tauranga	6·77	12	3·69	3·58
13	Maraehako Station, Opotiki	16·48	12	11·00	3·48
14	Gisborne	5·92	12	2·65	3·63
15	Taupo	2·13	5	0·85	2·82
16	Napier	1·40	7	0·50	2·92
17	Maraekakaho Stn., Hastings	1·30	10	0·41	2·52
18	Taihape	1·07	9	0·29	2·52
19	Masterton	1·78	7	0·74	2·70
20	Patea	1·08	5	0·38	2·51
21	Wanganui	0·84	3	0·40	2·52
22	Foxton	1·15	8	0·64	2·06
23	Wellington (Karori) ..	1·78	5	1·48	3·07
	South Island.				
24	Westport	1.02	3	0·60	5·35
25	Greymouth	3·30	7	1·70	5·99
26	Hokitika	3·28	10	1·79	7·31
27	Ross	4·72	6	1·54	8·45
28	Arthur's Pass	3·89	5	2·23	10·17
29	Okuru, South Westland ..	7·47	7	5·72	7·92
30	Collingwood	1·26	7	0·52	5·63
31	Nelson	0·62	1	0·62	2·77
32	Spring Creek, Blenheim ..	0·78	2	0·75	2·25
33	Tophouse	0·54	2	0·38	4·39
34	Hanmer Springs	1·65	8	0·52	3·04
35	Highfield, Waiau	1·64	5	0·60	2·54
36	Gore Bay	1·22	4	0·79	2·93
37	Christchurch	0·75	6	0·50	1·77
38	Timaru	1·72	7	1·36	1·82
39	Lambrook Station, Fairlie ..	0·94	4	0·76	1·89
40	Benmore Station, Clearburn	0·56	4	0·26	1·36
41	Oamaru	1·09	7	0·68	1·68
42	Queenstown	1·20	4	0·59	1·98
43	Clyde	0·73	2	0·51	0·99
44	Dunedin	1·66	9	1·40	2·69
45	Wendon	0·86	7	0·50	2·03
46	Gore	1.45	8	0·89	2·65
47	Invercargill	1·90	12	0·70	2·85
48	Puysegur Point	5·03	18	1·18	4·96
49	Half-moon Bay	2·04	9	0·52	4·13

—*Edward Kidson, Director of Meteorological Services, Wellington, 6th March, 1930.*



MAP OF NEW ZEALAND, SHOWING RAINFALL STATIONS COMPRISED IN *Journal* LIST.

(No. 5A, Rotorua, should be added to North Island list above.)

Minor Crops.—Among other minor crops grown in the 1928–29 season were the following, the figures being total areas for the Dominion: Artichokes (for stock), 210 acres; kumeras, 195 acres; pumpkins and marrows (for stock), 921 acres; osiers, 40 acres; chicory, 54 acres; carrots and parsnips (for stock), 1,013 acres; onions, 880 acres; hops, 608 acres; tobacco, 1,000 acres.

CLASSIFICATION OF CATTLE IN NEW ZEALAND AT 31st JANUARY, 1929.

Land District (including Interior Boroughs).	Bulls Two Years Old and over, for Stud.		Cows and Heifers Two Years Old and over, for Dairying.		Other Cows and Heifers Two Years Old and over.	Heifers One and under Two Years Old.	Steers Two Years Old and over.	Steers and Bulls One and under Two Years Old.	Calves under One Year Old.		Total Cattle.
	For Beef Purposes.	For Dairy Purposes.	In Milk.	Dry.					Heifer.	Steer.	
North Auckland ..	1,030	7,882	208,218	16,076	42,132	61,336	37,850	18,356	71,208	23,108	487,196
Auckland	1,591	12,951	377,607	14,695	63,662	98,381	59,389	19,615	115,475	25,198	788,564
Gisborne	3,095	1,248	33,009	3,940	105,014	33,424	38,492	25,033	40,961	32,504	316,720
Hawke's Bay	1,602	1,713	46,916	4,702	50,907	23,533	32,662	12,579	26,741	16,478	217,833
Taranaki	594	7,578	199,439	8,207	25,501	44,387	17,198	6,640	54,895	8,713	373,152
Wellington	3,945	7,128	185,980	12,911	129,084	67,168	91,002	35,220	81,040	42,131	655,609
Nelson	126	1,200	25,606	2,136	6,495	7,534	5,135	2,759	8,319	3,951	63,261
Marlborough	235	672	14,750	1,386	6,719	4,776	4,136	2,499	5,739	2,942	43,854
Westland	166	497	11,591	1,343	6,450	4,709	5,340	2,602	5,290	3,201	41,189
Canterbury	383	2,675	70,746	4,605	15,156	19,213	16,061	7,473	22,131	10,281	168,724
Otago	329	2,106	49,466	4,621	11,504	15,381	13,552	6,816	16,073	8,816	128,664
Southland	340	3,001	67,876	5,237	14,916	19,772	10,958	8,749	20,639	9,536	161,024
Totals, Dominion, 1929	13,436	48,651	1,291,204	79,859	477,540	399,614	331,775	148,341	468,511	186,859	3,445,790
Totals, Dominion, 1928	11,710	47,624	1,242,729	109,669	451,189	362,624	369,553	128,918	405,671	144,082	3,273,769

—Census and Statistics Office.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 30th January to 27th February, 1930, include the following of agricultural interest:—

No. 62544: Manure-distributor; H. T. Lowry, Patumahoe. No. 62412: Garden-stake; W. A. Hughes, Cromwell. No. 62601: Marking meat-products; Swift and Co., Chicago, U.S.A. No. 64081: Watering-appliance for animals; W. G. Beatty, Fergus, Ontario. No. 61410: Animal-trap; F. L. Clark, Upper Hutt. No. 63794: Dried powder from whey; N.Z. Sugar of Milk and Casein Co., Ltd., Dunedin. No. 64135: Milking-machine; Aktiebolaget Separator, Stockholm, Sweden. No. 61124: Wool-cleaning; H. G. Howell, Taradale, and T. R. Howell, Napier. No. 61543: Separator-bowl; Aktiebolaget Separator, Stockholm, Sweden. No. 62551: Dosing animals; C. M. McDonald, Invercargill-Glencoe R.D. No. 62552: Dosing sheep with tablets; C. M. McDonald, Invercargill-Glencoe R.D. No. 63511: Manure-distributor; J. M. Malcolm, Auckland. No. 63890: Treating clover-seeds; Warren-Teed Seed Co., Chicago, U.S.A. No. 63987: Flax-treatment; W. E. Langguth, Auckland. No. 64022: Ventilation of cream-can; C. W. Holman and W. Black, Hamilton. No. 64098: Manure distributor; J. Bamford and C. J. Bamford, Uttoxeter, England. No. 64111: Steel post; G. D. Watson, Sydney, N.S.W.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

COMMERCIAL GROUND LIMESTONES EXAMINED.

A NUMBER of commercial ground limestones were examined during the year 1928–29 at the Chemical Laboratory of the Department of Agriculture for quality and fineness of grinding. The Chief Chemist remarks on these in his annual report as follows:—

Y/299, from the Gore district, was a fairly well ground limestone containing 81 per cent. carbonate of lime. Y/338, from Westport, was a high-grade limestone (94·25 per cent. carbonate) of moderate fineness. Y/149, from Kakahu, Canterbury, was well ground, and contained 85 per cent. carbonate of lime. Y/669 was a finely ground stone, containing 89 per cent. carbonate of lime, from Dunback, Otago. Y/734, from Oamaru, was 97·5 per cent. pure, and was a well-ground sample. Y/574–76 were from Southland; Y/574 and 575 contained 60 per cent. and 76·5 per cent. carbonate of lime respectively; Y/576 was of much greater purity—91·5 per cent.—and was very finely ground. Y/557, from Limehills, Southland, was ground to a satisfactory fineness, and contained 90 per cent. carbonate of lime. Y/1073, from Toko, Taranaki, contained 86 per cent. carbonate, and might with advantage have been more finely ground. Y/1076 was a fairly well-ground stone of low grade, from the North Auckland District; it contained 64·1 per cent. carbonate of lime. Y/838, from Silverdale, Auckland, was a well-ground stone, containing 74 per cent. carbonate of lime. The prices charged for these commercial ground limestones (where stated) varied from 12s. to 18s. per ton, bags extra. Several samples of quicklime and slaked lime were also analysed. These were all found to be well "burnt" from good-quality limestones.

Noxious Weeds Orders.—The Hawke's Bay County Council has declared African boxthorn to be a noxious weed within its jurisdiction. The Heathcote County Council has similarly declared the following plants (at the same time revoking all its previous orders in reference to noxious weeds): Blackberry, ragwort, African boxthorn, Bathurst burr, burdock, Cape honey-flower, dock, fennel, goat's rue, hakea, Japanese wineberry, lantana, ox-eye daisy, pennycress, periwinkle, St. John's wort, toad flax, viper's bugloss, winged thistle, Californian thistle, sweetbrier, barberry, broom, Capeweed, cut-leaved psoralea, elderberry, foxglove, gorse, hemlock, kangaroo acacia, lupin, Paterson's curse, prickly pear, pennyroyal, spiderwort, tauhinu, tutsan, wild turnip, woolly nightshade. Thistles: Any species of *Carlina* (stemless thistle), *Carduus* (common plume or Scotch thistle), *Cnicus* (woolly-headed thistle), *Centaurea* (star thistle), *Silybum* (milk thistle).

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

REMEDIES FOR INTERNAL PARASITES IN LAMBS.

G. A. JENKINS, Marohemo :—

In the January issue of the *Journal* appears an article on hogget mortality; and concerning dosing for worms two preparations are mentioned. The 1-per-cent. bluestone solution is quite simple and self-explanatory as far as preparation is concerned, but for the turpentine, linseed-oil, and soda drench no details of preparation are given. I should be pleased if you would let me know the quantities of each recommended in the mixture. Also, does it mean washing-soda or bicarbonate?

The Live-stock Division :—

The 1-per-cent. bluestone solution is the agent most commonly used and recommended for the treatment of parasites in lambs. In regard to the use of turpentine the following may be taken as medicinal doses for lambs: A small teaspoonful (one dram) each of turpentine and baking-soda (bicarbonate) are added to 2 fluid ounces of raw linseed-oil, this being a dose for one lamb. The mixture should be well shaken up. The soda is added only with a view to forming an emulsion. If desirable the same quantity of turpentine may be given in milk, the soda being omitted. Thorough shaking is advised to mix the turpentine. Care also is necessary when dosing with a turpentine solution, as the animals are liable to cough. Large quantities are made up in proportion: thus 10 oz. each of turpentine and baking-soda added to a gallon of raw linseed-oil will provide for eighty lambs, allowing each lamb 2 fluid ounces of the mixture.

ESTABLISHING PASPALUM ON UNPLOUGHABLE COUNTRY.

"K4," Russell :—

Kindly advise me the best and quickest method of laying a permanent pasture of paspalum on unploughable clay hills, such as found near the coast in the North Auckland territory. Please state best time to sow, preparation of seed, and other information that would be useful.

The Fields Division :—

Under the conditions mentioned paspalum is likely to be slow in establishing. Surface sowing with from 6 lb. to 8 lb. of seed per acre in November or early December is the best method. With the establishment of scattered plants over the area the sward will be rapidly thickened by allowing as much reseeding as possible in the early stages. The seed should give a good percentage of germination, and the surface should be clear of rough grass or other growth. Firing or heavy stocking should precede the sowing if necessary. Finally, it must be remembered that in order to thrive paspalum requires fairly good surface fertility, and it is possible that danthonia and brown-top would do better on the country you refer to.

STARTING A VINEYARD IN HANGATIKI DISTRICT.

W. G. J., Hangatiki :—

Please inform me regarding the best way to start growing outdoor grape-vines in this district for table purposes, and best sorts to grow. The plot would be on rolling country lying to the sun, with loam soil and natural drainage.

The Horticulture Division :—

To establish strong vines which will crop at least a year earlier than vines planted in superficially cultivated soil (and this applies more especially to soils

of a compact nature) it is essential to cultivate the land deeply and to subsoil it. If it is in pasture the turf should be broken up previously to being turned in; or if it is in fallow a crop of lupins can be grown for the purpose, or a top dressing of "tailings" from blood-and-bone manure applied. This consists of bits of wool, bone, horn, &c., and helps to feed the vines for several seasons. If the plot is to be prepared with the spade—which is the better way—the soil should be worked so that the top soil, turf, &c., forms a layer 6 in. to 12 in. below the surface, and another 6 in. or more below it should be subsoiled. If a plough is used this method should be approached as near as possible, so that the roots of the vines, which prosper particularly well in newly-turned-in top soil, can spread freely through the ground. After the vines are planted superficial cultivation, so as to avoid injuring the rootlets which feed near the surface in spring, is all that is required to keep the soil free of weeds and in a condition of fine tilth. The routine cultivation consists of ploughing out lightly from the vines in autumn, and disking inward in spring and summer.

The most popular market varieties are Albany Surprise and Black Hamburg (both black grapes). The first-named sells especially well on the Auckland and Hamilton markets; but it would not be prudent to plant many of either variety until you are satisfied that your local conditions suit them. With a view to ascertaining which are the most suitable varieties to grow, especially from a ripening point of view, we would recommend, in addition to Albany Surprise and Black Hamburg, which ripen in March, growing a few of each of the following: Madeleine Royale, Goldriesling, Agostenga, Chasselas Doré Salomon, Portugais Bleu, Iona, Muscat Hambro, and Temprano. These ripen approximately in the order given, and from among them a continuous supply over a period of about three months should be obtained. These varieties can be obtained in August (though it is advisable to order earlier) from our Te Kauwhata experimental vineyard at listed prices.

MARE IN POOR CONDITION.

S. P. A., Pleasant Point:—

I have a draught mare about ten years old, and this season she is in unusually poor condition and is pot-bellied, though eating well. I think she has bots, and should be glad of a prescription and method of treatment to get rid of them. She is not doing any work, or practically none.

The Live-stock Division:—

It is not usual for horses harbouring bots alone to develop "pot-bellies." The poor condition of your mare, together with her abdominal enlargement, are more likely to be due to the presence of intestinal parasites and derangement of the digestive organs. A good treatment would be—Turpentine, 2 oz., raw linseed-oil, 1 pint, given as one dose and repeated in ten days. During that interval give one powder daily containing ferri carbonate, 2 drams; soda bicarbonate, 2 drams, in food. The animal's teeth should be carefully examined to make sure that mastication is good.

Wheat Research.—At the February meeting of the Research Council the Chairman made the following reference to this work: "The scope of the wheat investigations has now been fully extended. A large number of additional crosses has been made at Lincoln College during the past season, and these, together with the product of others made in previous seasons, are now being harvested. The appointment of a baker to the Institute will enable baking tests to be made of flour from wheats previously analysed, thus giving the fullest information on all of the factors influencing wheat and flour quality. Arrangements have been made whereby the services of the Institute will be available to millers for the purpose of effecting improvements in and standardizing the quality of their flour output. A valuable preliminary research on the possibility of using header harvesters in the climatic conditions prevalent in New Zealand wheat-growing districts has been carried out. The actual field trials conducted with these machines this season will be surveyed by the Institute with a view to estimating the result on wheat and flour quality of such a method of harvesting."

BONUS OFFERED FOR MAJOR IMPROVEMENTS IN MANUFACTURE OF PHORMIUM FIBRE.

THE following notice was published in the *New Zealand Gazette* of 13th February, 1930, over the name of the Hon. G. W. Forbes, Minister of Agriculture:—

Subject to the conditions hereinafter appearing, the New Zealand Government hereby offers to pay £10,000 as a bonus or bonuses for major improvements in connection with the extraction and dressing of fibre from the New Zealand hemp-plant (*Phormium tenax*).

(1) The machine or process in regard to which the whole or any part of the bonus is to be paid shall be recommended by a committee set up by the Government, and shall be approved by the Government.

(2) The £10,000 will be paid wholly or in part for a commercially practicable process of extracting and dressing the fibre of New Zealand hemp (*Phormium tenax*), whether by machinery or otherwise, whereby there shall be obtainable—(*a*) A greatly improved quality of fibre marketable at a higher price; (*b*) a considerably greater quantity of strong white fibre per ton of green leaf; (*c*) a substantial reduction in the cost of producing the fibre: Provided that in determining the amount of the bonus to be paid for any such process due regard shall be had to the rate of any royalty required to be paid by millers for the use of such process, and no bonus whatever will be paid—(i) Unless it can be satisfactorily demonstrated that the improved process submitted in comparison with the best of present methods will enable the net returns from an efficient flax-mill to be increased by at least 15 per cent; or (ii) if the amount of any such royalty will absorb the whole or substantially the whole of the increased net return above referred to.

(3) Any applicant for the bonus or part of the bonus must have fulfilled the following conditions at the time of application: (*a*) The machine or process in question must have extracted the fibre from not less than 500 tons of green leaf; (*b*) The fibre extracted from the 500 tons of green leaf must have been graded by a Government Grader, and not less than 90 per cent. of such fibre must have reached a grade not lower than "good fair."

(4) Applications for the bonus must be addressed to the Director-General, Department of Agriculture, Wellington, and must reach him not later than noon of the 30th November, 1931. They must be enclosed in an envelope clearly marked "Application for *Phormium* bonus."

(5) Each applicant shall state what royalty, if any, would require to be paid by millers for the use of his process during the currency of his patent rights.

(6) As soon as possible after the expiry of the time for receiving applications for the bonus (30th November, 1931), the Government will appoint a committee of not less than five—of whom two shall be New Zealand hemp-millers—to open and examine the applications, to investigate such of the competing machines or processes as it considers worthy of trial, and to make recommendations to the Government as to the payment of the bonus, having regard to the amount of royalty, if any, specified in such applications.

(7) Each applicant must give, at his own expense, such reasonable demonstrations of the working of his machine or process as shall be demanded by the said committee, and such demonstrations shall take place in New Zealand.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates during the remainder of the 1929–30 season have been notified by agricultural and pastoral associations:—

Methven A. and P. Association: Methven, 29th March.
Cheviot A. and P. Association: Cheviot, 3rd April.
Oxford A. and P. Association: Oxford, 3rd April.
Flaxbourne A. and P. Association: Ward, 10th April.